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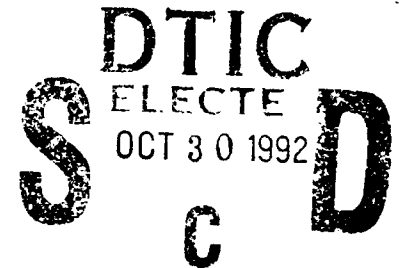
TITLE: 5TH ANNUAL TRAUMA ANESTHESIA AND CRITICAL CARE SYMPOSIUM

PRINCIPAL INVESTIGATOR: Christopher M. Grande, M.D.

CONTRACTING ORGANIZATION: International Trauma Anesthesia &
Critical Care Society (ITACCS)
P.O. Box 4826
Baltimore, Maryland 21211

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1 October 1992 Published Proceedings

5th Annual Trauma Anesthesia and Critical
Care Symposium

Grant No.
DAMD17-92-J-2018

Christopher M. Grande, M.D.

International Trauma Anesthesia & Critical
Care Society (ITACCS)
P.O. Box 4826
Baltimore, Maryland 21211

U.S. Army Medical Research and Development
Command
Fort Detrick
Frederick, Maryland 21702-5012

5th Annual Trauma Anesthesia and Critical Care Symposium held
June 11-12, 1992, Amsterdam, The Netherlands

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The pediatric trauma patient presents unique problems. An overview as well as specific aspects in the management of closed head injury; initial resuscitation and transport of the injured child will be presented. Additionally, a "hands-on" mini-session on interosseous infusion will be presented.

Symposium, Trauma, Anesthesia, RA 2

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5th Annual Trauma Anesthesia and Critical Care Symposium

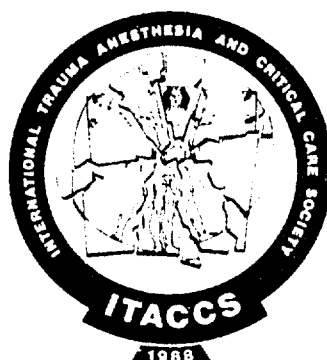
June 11 - 12, 1992

(immediately preceding the 10th World Congress of Anaesthesiologists)

Amsterdam, The Netherlands

Jointly Sponsored by

The International Trauma Anesthesia and Critical Care Society



And

Departments of Traumatology and Anesthesiology
The Shock Trauma Center
Maryland Institute for Emergency Medical Services Systems

The University of Maryland School of Medicine
Baltimore, Maryland

Association of Anaesthetists of Great Britain and Ireland

U.S. Army Medical Research and Development Command

Unified Departments of Anesthesiology and Critical Care Medicine
Albert Einstein College of Medicine
New York, New York

The Borden Institute - Office of the Surgeon General
United States Army

Netherlands Society for Anesthesiology

Japan Society for Clinical Anesthesia

Department of Anesthesiology
Parkland Memorial Hospital
University of Texas, Southwestern Medical School
Dallas, Texas

Japanese Society of Reanimatology

Perioperative Trauma Anesthesia Services
Department of Anesthesiology
Milton S. Hershey Medical Center
Pennsylvania State University College of Medicine

Klinik für Anästhesiologie
Klinikum der Johannes Gutenberg-Universität
Mainz, Germany

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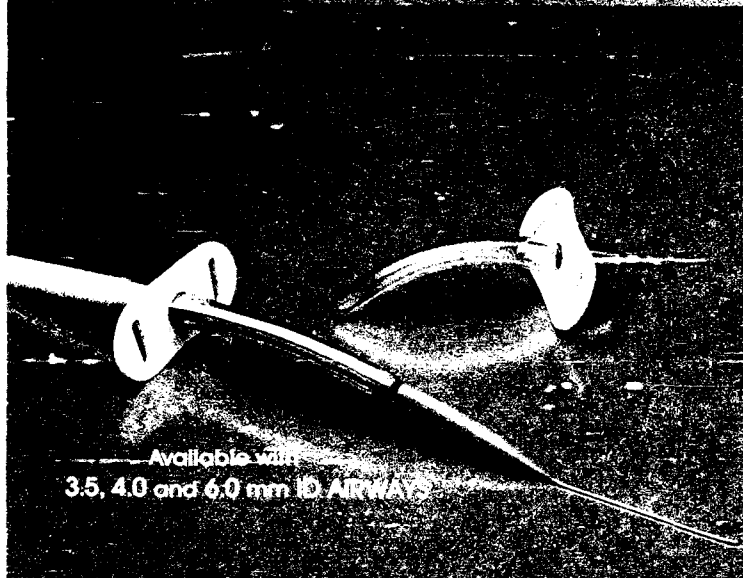
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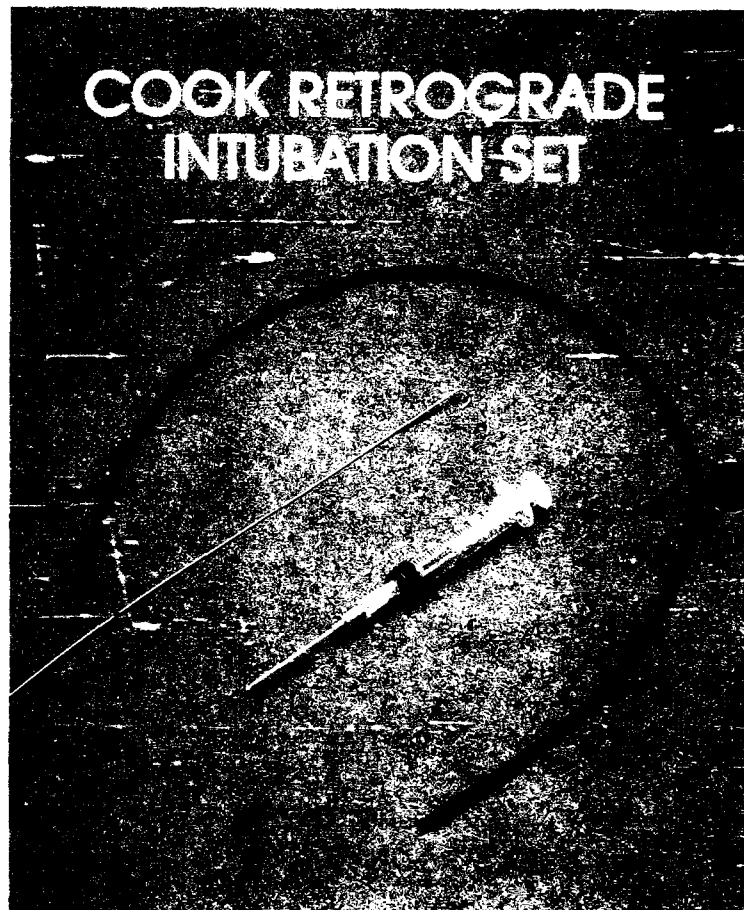
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5th Annual Trauma Anesthesia and Critical Care Symposium

PROGRAM

WEDNESDAY, JUNE 10, 1992

5:30 P.M. - 7:30 P.M.

Pre-Registration
Amsterdam Marriott Hotel (Conference Level)
Stadhouderskade 19-21, 1054ES Amsterdam, The Netherlands

THURSDAY, JUNE 11, 1992

7:00 A.M.

Registration. Continental Breakfast

7:30 A.M.

Opening Addresses

Christopher M. Grande, M.D.

John K. Stene, M.D., Ph.D.

PLENARY SESSION I

Moderator: Adolph H. Giesecke, M.D.

7:40 A.M.

History of Trauma Anesthesia: Antiquity to 1987

David J. Wilkinson, MBBS, FFARCS

8:20 A.M.

History of Trauma Anesthesia: 1987 to Present

Christopher M. Grande, M.D.

8:50 A.M.

The International Trauma Anesthesia Survey

Jerry P. Nolan, MB, ChB, FFARCS

Michael J. Parr, MBBS, MRCP, FCAnaes

9:30 A.M.

Panel Session: Questions and Answers

Adolph H. Giesecke, M.D. and Faculty

9:40 A.M.

Break - Visit Exhibits and Posters

PLENARY SESSION II

Moderator: John K. Stene, M.D., Ph.D.

10:00 A.M.

Trauma Anesthesia in Norway

Torben Wisborg, M.D., DEAA

10:20 A.M.

Trauma Anesthesia in Austria

Walter Mauritz, M.D.

10:40 A.M.

Trauma Anesthesia in South Africa

David E. Morrell, MBChB, FFA(SA)

11:00 A.M.

The Persian Gulf Crisis:

A Retrospective Analysis from an Anesthesia Perspective

Brian E. Condon, M.D.

Colin A. B. McLaren, MB, ChB, FFARCS

John Restall, M.D., BS, FFARCS

Mohamed Seraj, MB, BCh

12:15 P.M.

Panel Session: Questions and Answers

John K. Stene, M.D., Ph.D. and Faculty

12:30 P.M.

Lunch (On Your Own) - Visit Leidesplein and Vondelpark

2:30 P.M.

SIMULTANEOUS BREAKAWAY SESSIONS

I. Pediatric Trauma Anesthesia

Moderator-in-Chief: Jeffrey M. Berman, M.D.

Moderators: Pierre Carli, M.D.

J. J. deLange, M.D.

Steven Hall, M.D.

Aleksandra Matzwick, M.D.

Linda Jo Rice, M.D.

The pediatric trauma patient presents unique problems. An overview as well as specific aspects in the management of closed head injury; initial resuscitation and transport of the injured child will be presented. Additionally, a "hands-on" mini-session on interosseous infusion will be presented.

DID YOU KNOW THAT MANY EMS SYSTEMS REQUIRE THAT PROFESSIONALS WHO MANAGE TRAUMA OBTAIN AS MANY AS 20 CREDIT HOURS ANNUALLY AND SPECIFICALLY IN TRAUMA?

5th Annual Trauma Anesthesia and Critical Care Symposium

FACULTY

Charles P. Kingsley, M.D.

Chief, Department of Clinical Investigation
Staff Anesthesiologist
Brooke Army Medical Center
Associate Professor of Anesthesiology
University of Texas at San Antonio, Health Center
Major, U.S. Army
San Antonio, Texas

Walter Mauritz, M.D.

Professor of Anesthesia and Critical
Care Medicine
University of Vienna
Chairman, Department of Anesthesia and
Critical Care
Trauma Hospital "Lorenz Bohler"
Vienna, Austria

Aleksandra J. Mazurek, M.D.

Assistant Professor of Clinical Anesthesia
Northwestern University Medical School
Attending Anesthesiologist
Children's Memorial Hospital
Editorial Board, ITACCS Newsletter
Chicago, Illinois

T. Michael Moles, MBBS, FFARCS, DTMH

President,
Hong Kong College of Anaesthesiologists
Chairman, International Coordination
Committee, ITACCS
Member, CPR Committee, WFSA
Major, RAMC, 10 Bn Parachute Regiment,
TAVR
Author, *Management of the Injured Patient*
Editor, *Recent Advances in Anaesthesia, Immediate
and Critical Care*
Hong Kong

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Professor of Anaesthesia
University of the Witwatersrand
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Johannesburg Hospital
Chairman, Faculty of Anaesthetists of the
College of Medicine of South Africa
Secretary and Past President, South African
Society of Anaesthetists
Secretary, Council of Academic Anaesthetists
of South Africa
South Africa

Mark T. Murphy, M.D.

Director, Trauma Anesthesia and Critical Care
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Harvard Medical School
Major, Medical Corps, USAR
Brigade Surgeon, 187th Infantry Brigade
Member, Education and Training Committee,
ITACCS
Boston, Massachusetts

Jerry P. Nolan, MB, ChB, FFARCS

Registrar in Anesthesia
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Member, Education and Training Committee,
ITACCS
Editorial Board, ITACCS Newsletter
Bristol, England

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Visiting Assistant Professor
Department of Anesthesiology
University of Maryland School of Medicine
Attending Anesthesiologist
The Shock Trauma Center, MIEMSS
University of Maryland Medical System
Baltimore, Maryland

John Restall, M.D., BS, FFARCS

Brigadier-General, Consultant
Adviser in Anaesthetics and Resuscitation
to the British Army
Cambridge Military Hospital
Member, Council of Association of
Anaesthetists of Great Britain and Ireland
Member, Executive Committee, Resuscitation
Council, UK
Hampshire, England

Linda Jo Rice, M.D., MC, USNR

Associate Professor of Anesthesiology
Assistant Professor of Pediatrics
Children's National Medical Center
Commander, USNR
Commanding Officer, George Washington
University Navy Reserve PRIMUS Unit
Washington, DC

Peter Safar, M.D.

Distinguished Service Professor of
Resuscitation Medicine
University of Pittsburgh School of Medicine
Director, International Resuscitation
Research Center
University of Pittsburgh
Special Ad Hoc Advisor, ITACCS
Pittsburgh, Pennsylvania

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Associate Professor and Medical Director
Department of Anaesthesia and ICU
College of Medicine
King Saud University, Riyadh
Chairman, National CTR Committee
Chairman, CTR Committee King Khalid
University Hospital
Consultant to Civil Defense
President, Saudi Anaesthetic Association
Saudi National Representative, ITACCS
Riyadh, Saudi Arabia

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Consultant Anaesthetist
Medical Director of Day Surgery Centre
St. Bartholomew's Hospital
Curator of Charles King Collection of
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Editor, *Proceedings of the History of
Anaesthesia Society*
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Torben Wisborg, M.D., DEAA

Consultant Anesthesiologist and Chairman
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Intensive Care
Hammerfest Hospital, Hammerfest
Flight Anesthesiologist, Norwegian Air
Ambulance, Bergen and Royal
Norwegian Rescue Helicopter Service, Bodø
Hammerfest, Norway

PLENARY SESSION I

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Panel Session: Question and Answers

Adolph H. Giesecke, M.D. and Faculty

HISTORY OF TRAUMA ANESTHESIA: 1987 TO PRESENT

Christopher M. Grande, M.D.

I. Introduction and Historical Perspective

- A. What is Trauma Anesthesia?
- B. Trauma Centers
- C. Standards of Care
- D. Perioperative Considerations
- E. The Trauma Patient

II. International Variations in the Role of the TA/CCS

- A. The Trauma Team: Leader vs. Member
- B. Pain Management
- C. Teacher/Trainer
- D. Critical Care Transport
- E. Prehospital Care

F. Military

G. Disasters/Mass Casualty Situations

II. Problems, Misconceptions, Solutions

A. Interactions of Anesthesiologists with the Trauma System

B. Unrealistic Expectations

C. Formal Recognition of Trauma Anesthesia

D. Turf Wars and Communication Breakdown in Traumatology

E. Economics of Trauma

F. Trauma Anesthesia Program Task Force

IV. Formalized Training Programs for the TA/CCS

A. Unique Training Opportunities

V. What Next? The Future of Trauma Anesthesia

INTERNATIONAL SURVEY OF TRAUMA ANESTHESIA

JP Nolan and MJA Parr

During 1990/1991 as part of a larger international project, a National Survey of Trauma Anesthesia was designed by ITACCS, coordinated by the LOTAS Group, and carried out by members of MIEMSS Anesthesiology Department.

I. Aim of Survey

- A. Identify Tasks Frequently Performed by Anesthesiologists Caring for Trauma Victims.
- B. Identify Monitoring, Drug and Anesthetic Techniques.
- C. Use the Task Analysis Data obtained in the Level One Trauma Anesthesia Simulation (LOTAS) Project with the followings aims:
 - 1. Predict the Needs of Trauma Anesthesia
 - 2. Construct Computer Simulation of Trauma Anesthesia
 - 3. Develop Computer Models of Workload, Performance and Decision Making in Trauma Anesthesia

II. Survey Design

- A. Survey questionnaires sent to all the Anesthesia Departments of Level One Trauma Centers in the United States. It was divided into sections to cover:

1. Facility Data
 - a. Total Beds
 - b. Trauma Beds
 - c. Trauma Admissions
 - d. Resuscitation Area Beds
 - e. Trauma Operating Rooms
 - f. Trauma Team
 - g. Anesthesia Involvement in the Trauma Team
2. Task Analysis
 - a. Basic Airway Management
 - b. Advanced Airway Management
 - c. Patient Monitoring
 - d. Fluid Infusions
 - e. Anesthesia Induction and Maintenance
 - f. Other Tasks
3. Drug Usage
 - a. Neuromuscular Blockers
 - b. Induction Agents
 - c. Volatile Agents
 - d. Analgesics
 - e. Vasoactive Drugs
4. Controversial Areas
 - a. Nitrous Oxide
 - b. Laryngoscopy and Intubation with Cervical

Spine Trauma

III. Anesthesia Protocols

IV. Miscellaneous Topics

PLENARY SESSION II

Moderator: John K. Stene, M.D., Ph.D.

Trauma Anesthesia in Norway

Torben Wisborg, M.D., DEAA

Trauma Anesthesia in Austria

Walter Mauritz, M.D.

Trauma Anesthesia in South Africa

David F. Morrell, MBChB, FAA(SA)

The Persian Gulf Crisis:

A Retrospective Analysis from an Anesthesia Perspective

Brian F. Condon, M.D.

Colin A. B. McLauren, MB, ChB, FFARCS

John Restall, M.D., BS, FFARCS

Mohamed Seraj, MB, BCh

Panel Session: Questions and Answers

John K. Stene, M.D., Ph.D. and Faculty

TRAUMA ANESTHESIA IN NORWAY

Torben Wisborg, M.D., DEAA

I. Norway - Geography and Demographics

A. Trauma in Norway

II. Norwegian Anesthesiologists

A. Role in Trauma Care

III. Prehospital Trauma Care

A. Emergency Medical Communication Centers

B. Ambulance Services

C. National Air Ambulance Plan

D. Norwegian Air Ambulance

IV. In-hospital Trauma Care

A. Anesthesia

B. Intensive care

V. Trauma-Related Activities and Research by Norwegian Anesthesiologists

TRAUMA ANESTHESIA IN AUSTRIA

Walter Mauritz, M.D.

I. Factors Influencing Trauma Care

- A. Geography
- B. Population

II. Epidemiology of Trauma in Austria

III. The Austrian EMS

- A. Structure
- B. The Role of the Anesthesiologists

IV. Trauma Care Facilities

- A. Surgical Departments
- B. Trauma Departments or Hospitals

V. Specialities Involved in Trauma Care

- A. Anesthesiologists
- B. Trauma Surgeons

TRAUMA ANESTHESIA IN SOUTH AFRICA

David F. Morrell, MB, ChB, FFA(SA)

I. Historical Perspectives

- A. Ethnic Diversity and Tradition
- B. The Apartheid Era
- C. The "New South Africa"

II. The Spectrum of Trauma in South Africa

- A. Urbanization
- B. Incidence of Trauma
- C. The Pattern of Trauma
 - 1. Vehicular Trauma
 - 2. Firearms
 - 3. "Traditional" and "Cultural" Weapons
- D. The Economic Impact

III. Trauma Management in South Africa

- A. Facilities for Prehospital Treatment
- B. Hospital Management
- C. The Johannesburg Experience

IV. Special Features of Trauma in South Africa

- A. Penetrating Injuries of the Heart
- B. Penetrating Injury of the Neck
- C. High Velocity Gunshot Wounds
- D. Shotgun Wounds

- E. "Necklace" Burning
- F. Hack and Stab Wounds

V. The Impact of AIDS on Trauma Management

VI. Conclusion

- A. Cost-effective Health Management

THE PERSIAN GULF CRISIS:
A RETROSPECTIVE ANALYSIS FROM AN ANESTHESIA PERSPECTIVE -
HOW TO SPEND A MILLION POUNDS (OPERATION GRANBY)

C A B McLaren, MBChB, FFARCS

I. Historical Overview of Casualty Evacuation

II. The War Plan Central Europe - Saudi Arabia

III. The Problems:

- A. Casualty Projections
- B. Aircraft
 - 1. Fixed Wing
 - 2. Helicopters
- C. Flight Planning
- D. Casualty Reception:
 - 1. The Gulf
 - 2. United Kingdom
 - 3. Cyprus
- E. Medical In-Flight Teams Equipment

IV. The Answers

V. The Future

- A. Planning
- B. Training
- C. Finance

THE PERSIAN GULF CRISIS:
A RETROSPECTIVE ANALYSIS FROM AN ANESTHESIA PERSPECTIVE -
THE LOGISTICAL PROBLEMS OF PROVIDING A SERVICE: THE BRITISH VIEW

John Restall, MB, BS, FFARCS

- I. Operation Granby
 - A. Why the Name?
 - B. Who or What was Granby?
- II. Disposition of Surgical Facilities
 - A. Size of the Problem
- III. Initial Call-up and Training
 - A. NBC threat
 - B. BATLS
- IV. The effect on the relationship between the Army and the National Health Service
 - A. Cessation of Training
 - B. Cessation of Civilian Care
- V. Staffing
 - A. Numbers
 - B. Allocation of Expertise
 - C. Anesthetic Assistance

D. Effect on Other Military Hospitals

VI. Transition to War

A. Need for Highest Standard of Medical Care

B. Degradation of Skills

C. Audit and Research

VII. Problems

A. Climatic

B. Pests

C. Toxic Threat

VIII. Forward Resuscitation

A. Personnel

B. Equipment

THE PERSIAN GULF CRISIS:
A RETROSPECTIVE ANALYSIS FROM AN ANESTHESIA PERSPECTIVE -

How Much Have We Learned From the Gulf Crisis and War in Relation
to Toxic Chemical Warfare

M.A. Seraj, MB, BCh, FFARCSI, DA

I. Historical Background

- A. 18th Century Development
- B. Use by Different Countries in 20th Century
- C. War Time Use
- D. Peace Time Use

II. The Media in the Gulf Crisis

- A. Fear and Panic of Misusing Chemicals
- B. Considered by some to be an Excellent Way to Wake Up the
Nation

III. The Crisis Period

- A. The Majority did not believe there would be a War
- B. The Majority did not believe the Enemy had the Capability to use Chemical Weapons
- C. A Minority of Professionals attempted to address the Possibilities
 - 1. Medical
 - a. Symposia, Workshops, and Seminars
 - b. Policy and Procedure Development for Decontamination Centers
 - c. Training Program Development
 - 2. Civilian
 - a. Instructions on Meaning and Response to Warning Sirens
 - b. Instructions on Human Safety Against Toxic Chemical Attacks
 - c. First-Aid Training Program Development

IV. The War and the Aftermath Period

- A. In General, Public Denial of the Real Possibility of War

B. No Lessons Learned

1. Comparison to Developments in EMS Response to Heat Stroke During Islamic Pilgrimage (Hajj)

V. Recommendations

A. New Dimension of Experience and Knowledge for Medical Personnel, especially EMS.

B. Establishment of Continuous Medical Training Program

1. Direct curriculum at Variety of Medical Professionals
2. Should Include Theoretical and Practical Training

IV. Conclusions

M.I.E.M.S.S.

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Pediatric Trauma Anesthesia

Moderator in Chief: Jeffrey M. Berman, M.D.

*Moderators : Pierre Carli, M.D.
J. J. deLange, M.D.
Steven Hall, M.D.
Aleksandra Mazurek, M.D.
Linda Jo Rice, M.D.*

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BREAKAWAY SESSION

Pediatric Trauma Anesthesia

Moderator: Jeffrey A. Berman, M.D.

Intrasseous Infusion: Alexander J. Mazurek, M.D.

A didactic presentation covering the anatomy, physiology, rationale indications, risks, benefits, efficacy, and techniques of intraosseous infusion will be presented.

Additionally, there will be hands on "mini-session" utilizing anatomic simulators to develop clinical skills.

Head Injury: J.J. deLange, M.D., Ph.D.

Head injury is a major factor in morbidity and mortality of pediatric trauma victims. Pediatric and adult head injury will be compared regarding etiology, pathophysiology, treatment and outcome.

Initial Resuscitation and IV Access: Linda Jo Rice, M.D.

A systematic approach to the assessment of injury, type and quantity of initial fluid and or blood required will be discussed in the context of initial emergency department care. Additionally, the problem of IV access will be addressed and its particular

problems in the pediatric trauma patient presented.

Transport: Pierre A. Carli, M.D.

Mobile critical care\resuscitation team headed by trauma anesthesiologists are dispatched to administer in-field treatment to severely injured victims. Aggressive resuscitation and treatment is undertaken, including regional or general anesthesia for difficult extrication. The benefits and problems of this approach will be presented and discussed.

Patterns of Injury: Stephen C. Hall, M.D.

The expected injuries following a traumatic event are different in children and adults. Moreover there are specific injuries unique to certain age groups of children. These differences as well as the influence of demographic factors in injury patterns will be discussed.

INTRAVASCULAR ACCESS FOR THE PEDIATRIC TRAUMA PATIENT

Linda Jo Rice, MD

Washington, DC, USA

Establishing venous access is critically important in pediatric trauma patients, as in all trauma patients. Time is of the essence! Although cannulation of peripheral veins with intravenous cannulas is the traditional first-line approach, emergency trauma centers in the US are quick to proceed to femoral intravenous placement, saphenous vein cutdown or to intraosseous infusion. A large bore, short catheter is preferred for faster intravenous infusion.

PERIPHERAL INTRAVENOUS CANNULATION

The saphenous vein at the ankle is the best route for venous access in the hypovolemic patient. Although the antecubital fossa is also a useful site, one should remember that the artery lies close to the basilic vein at this site, and inadvertent arterial cannulation is possible. Usually 3 attempts or 90 seconds is spent attempting percutaneous venous access.

FEMORAL VEIN CANNULATION

This vein is large, and may be easier to enter than a more peripheral vein in a hypovolemic patient. Remember that the vein lies medial to the artery--once again, you may get into the artery rather than the vein.

CUTDOWN

The saphenous vein is the best route for cutdown because of its superficial location. Cutdowns in the groin area require more skill and knowledge of the anatomy, as it is easier to damage the artery and veins while cutting down for the femoral vein. Use a short, large-bore cannula for better flow characteristics.

INTRAOSSEOUS INFUSION

At this time, if intravenous access is not achieved within 3 minutes, many trauma centers will place an intraosseous needle in the anterior tibia of the child less than 3 years of age--occasionally even in older children. The bony landmarks are the proximal tibia, 1-2 fingerbreadths below the tibial tuberosity, on the anteromedial surface. An alternate site is 1-2 cm proximal to the medial malleolus on the anteromedial surface of the distal tibia. Prepare the site with antiseptic, then insert a stylet needle (an epidural or bone marrow needle will do) perpendicular to the bone or angled away from the joint with a boring motion until penetration into the bone marrow is felt by sudden loss of resistance. Remove the stylet and attach the infusion. The needle should stand without support, and the infusion should flow freely, although you need pressure or a large syringe to enhance the infusion rate.

SUMMARY: IT is vitally important to achieve rapid intravenous access in pediatric trauma patients. Old techniques have been rediscovered, and are saving childrens' lives.

Special Equipment for Trauma Anesthesia

Moderator in Chief: Charles P. Kingsley, M.D.

Moderators : Leland H. Hanowell, M.D.

Colin A. B. McLaren, MB, ChB, FFARCS

John Restall, M.D., BS, FFARCS

The first half of this session will begin with didactic presentations of desirable safety features of anesthesia equipment and features of field anesthesia machines and other portable anesthesia apparatus such as ventilators. The second half will involve practical "hands-on" demonstrations of available anesthesia equipment. In addition to the anesthesia equipment experts, representatives from each manufacturer will be available to address technical issues. The nature and method of presentation in this session will limit the number of participants.

II. Special Equipment for Trauma Anesthesia

- 2:30 **Opening Remarks** - *Charles P. Kingsley, M.D.*
- 2:35 **Pre-Hospital Equipment** - *Colin A. B. McLauren, MB, ChB,, FFARCS*
 Monitors and Ventilators
- 3:00 **Field Anesthesia Equipment** - *John Restall, M.D., BS, FFARCS*
- 3:30 **BREAK** - View Equipment
- 4:00 - 4:25 **Anesthesia Equipment in the Operating Room I** - *Charles P. Kingsley, M.D.*
 Vaporizers, Ventilators, Flowmeters
- 4:25 - 5:00 **Anesthesia Equipment in the Operating Room II** - *Leland H. Hanowell, M.D.*
 Electronic Ventilators, Ventilatory Modalities
- 5:00 **Discussion**

EQUIPMENT BREAKAWAY SESSION

Charles P. Kingsley, M.D.

I. **Anesthesia**

- A. **High Pressure Systems**
- B. **Low Pressure Systems**
- C. **Vaporizers**
- D. **Patient Circuits**
- E. **Ventilators**
- F. **Monitors/Safety Devices**

II. **Field Anesthesia Systems**

- A. **Anatomy**
- B. **Vaporizer**

ANESTHESIA EQUIPMENT SESSION
MECHANICAL VENTILATION FOR TRAUMA PATIENTS

Leland H. Hanowell, M.D.

Mechanical Ventilation of Noncompliant Lungs

A. Conventional Ventilators

- i. Role of Auto-PEPP
- ii. Relationship of Inspiratory Flow to Airway Pressure

B. Intensive Care Ventilators

II. Modes of Ventilation

A. Ventilation Modes Leading to Extubation

- i. T-Tube
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 - a. Resistance and Work of Breathing
 - b. Oxygen Consumption and Work of Breathing

B. Pressure Support Ventilation (PSV)

- i. Effect on Work Of Breathing
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- iii. Pressure Controlled Ventilation (PCV)
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TRAUMA ANESTHESIA IN THE FIELD:
EQUIPMENT AND SUITABLE TECHNIQUES

John Restall MB BS, FFARCS

- I. Brief History of Development
- II. Apparatus
 - A. Tri-Service Apparatus (TSA)
 - B. Universal PAC vaporizer
 - C. Ohmeda 9000 syringe pump
 - D. Cape TC 50 ventilator
- III. Additional Equipment
 - A. Monitors
 - B. Laryngeal Mask Airway
- IV. Analgesia
 - A. Morphine
 - B. Ketorolac
 - C. Patient Controlled Analgesia (PCA)
 - D. Regional Techniques
- V. Recovery
- VI. Resupply

Scientific Free Papers: Part I

Moderator in Chief: Enrico M. Camporesi, M.D.

Moderators : Adolph H. Giesecke, M.D.
John K. Stene, M.D., Ph.D.

During this session participants will give a brief oral presentation using slides of scientific material related to trauma anesthesia and critical care.

SCIENTIFIC ABSTRACTS: PART I

Organ Procurement in a French Trauma Center

Fibrinolytic Agents: A New Approach to the Treatment of the Adult Respiratory Distress Syndrome

Intraoperative Transesophageal Echocardiography to Rule Out Traumatic Aortic Rupture and Myocardial Contusion: A Case Report and Review

Lactic Acidosis During Anesthesia for Grafting Procedure in Extensively Burned Patients

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ARDS Following Multiple Trauma - Does Kinetic Positioning Represent a Crucial Supportive Treatment Strategy?

Interpleural Regional Analgesia in the Pain Management of Chest Trauma

Airway Management with Penetrating Neck Trauma: A Retrospective Study

The Beck Airway Airflow Monitor (BAAM®) Distinguishes Tracheal From Esophageal Intubation

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Resource Utilization for Penetrating Trauma to the Torso in Dallas County, Texas

Continuous Arteriovenous Rewarming (CAVR): Rapid Reversal of Hypothermia in Critically Ill Patients

Use of Permissive Hypercarbia to Reduce Minute Ventilation in Patients with Post-Traumatic ARDS Complicated by Severe Barotrauma

Cardiopulmonary Changes During Prosthetic Hip Surgery with Acrylic Bone Cement Evaluated by Means of Transoesophageal Echocardiography (TEE)

ORGAN PROCUREMENT IN A FRENCH TRAUMA CENTER

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In the last few years, with the continued improvement in immunosuppressive techniques, organ transplantation has become a therapeutic modality for patients with terminal heart, liver or kidneys failure. The lack of an adequate supply of cadaver organs and tissues for transplantation to those in need poses a major problem. Study of epidemiologic data may improve results of the difficult challenge of transplant organization.

Patients and methods

A 12-month, retrospective review of brain death patients, admitted in university hospital trauma center of Rouen, was undertaken to estimate donor organ availability, causes of brain death and determine reasons of procurement failure. Brain death was defined by coma, unresponsiveness to stimuli, apnea and flatline electroencephalogram.

Results

This review was carried out in an university hospital trauma center located in an area with about 1 000 000 inhabitants. 31 potential organs donors (21 males and 10 females, mean age= 26,5 years) were identified. Most frequent cause of brain death were major head injuries after traffic accident (13 cases) or after gun wound (9 cases). Other causes of brain death were medical brain damage (aneurysm, ischemic brain failure). Reasons of procurement failure in 11 patients included failure of initial resuscitation (45%), ineligibility for pathologic history (18%), and denial of consent (36%). Of 20 eligible donors, 19 (95%) were able to donate several vascular organs (heart, liver, kidney). In only one instance was an eligible donor not appropriately identified as such and only kidneys were harvested. Of the 74 organs harvested, 72 were transplanted in France (69) or in European countries (3).

Discussion

Major head injuries are the principal causes of brain death in our center, making trauma the principal source of organ procurement [1]. Based on data of this study, organ recovery rate is estimated at 20 patients/million population/year will survive initially and meet all eligibility requirements for organ donation. Failure of physiologic support to prevent early death (45%), and denial of consent (36%) were found to be the two major, potentially remediable causes of procurement failure in this study. Physiologic maintenance of potential donors is a major challenge and need a trained anesthesia team to manage successfully a subject with important physiological derangements with aim to maintain optimal organ perfusion [2]. French law is based on the policy of "presumed consent" but denial of consent was found to be the second cause of organ procurement failure. So health care professionals must improve public education. Multiple organ harvesting is purposed in all cases, and improvement of this procedure, when possible, could be an answer to the question of organ shortage. Organ harvesting from brain death patients is a major challenge and needs, in trauma centers, the existence of a medical coordinator with trained medical and paramedical team and adequate laboratory back-up and facilities.

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FIBRINOLYTIC AGENTS: A NEW APPROACH TO THE TREATMENT OF THE ADULT RESPIRATORY DISTRESS SYNDROME

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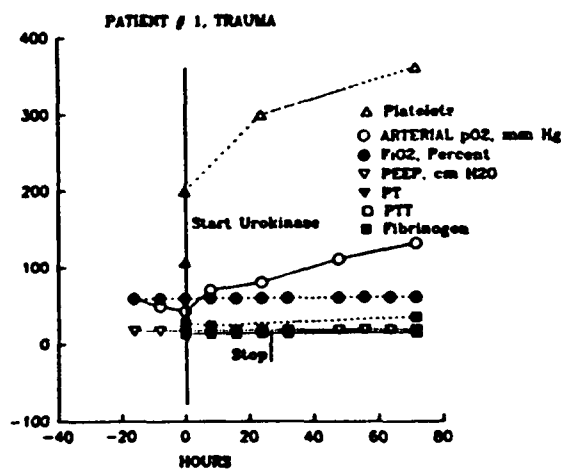
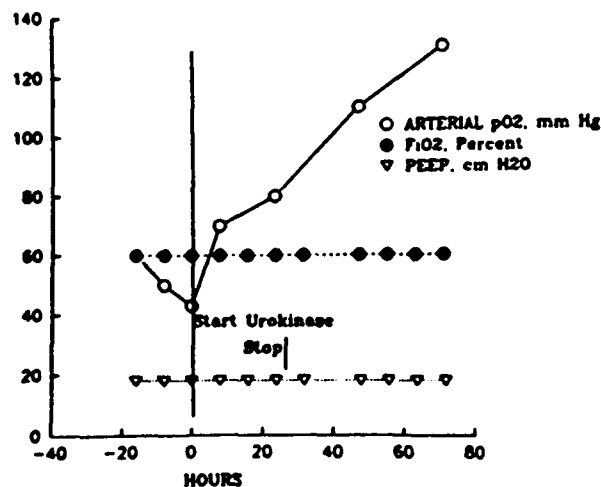
It has been shown that disseminated intravascular coagulation can produce acute renal failure, liver failure, and pulmonary failure. DIC can be initiated by trauma or sepsis or both. If intravascular coagulation is a cause of organ failure, it was reasoned that giving a substance that would cause clot dissolution would help. This was shown in dogs using thrombolytic in 1960-67. A clinical study was initiated to test the effect of plasminogen activators on clinical multiple organ failure, particularly acute pulmonary failure, after trauma or sepsis or both.

Methods and Materials: 19 patients suffering from ARDS secondary to trauma or sepsis or both. To enter the study the patients had to be refractory to the usual treatment with oxygen, given by volume cycled respirator and assisted by PEEP as indicated by a decreasing P_{aO_2} of 60 Torr or less under full treatment. Patients then were given a plasminogen activator IV over a 24 hour period.

Results: All patients responded to fibrinolytic therapy with immediate, dramatic and sustained increases in P_{aO_2} . In no cases were there abnormalities in clotting mechanism and no patient bled.

Discussion: DIC may cause the temporary or permanent occlusion of vital visceral capillaries. All organs may be involved but most common are the lungs (where circulating micro clots are filtered out), liver, kidneys, and gut. If multiple organ failure is due to DIC, then fibrinolytic therapy should help all the organs. There is evidence that liver and kidney damage may be prevented if fibrinolytic therapy is given before significant necrosis has been produced. However, the lungs are not subject to rapid necrosis due to capillary occlusion as much as the parenchymal organs. Therefore, restoration of capillary flow in the lungs by means of fibrinolytic therapy is more likely to restore lung function than in the liver or kidneys which may have significant focal necrosis by that time.

Summary and Conclusion: 1. Multiple organ failure may be due to DIC. 2. DIC may cause capillary occlusion in any and all organs but particularly the lungs, liver, kidneys and gut. Administration of fibrinolytic therapy will often restore significant blood flow and function to the lung capillaries. Lung tissue resists necrosis during temporary loss of perfusion better than liver or kidney tissue.



INTRAOPERATIVE TRANSESOPHAGEAL ECHOCARDIOGRAPHY TO RULE OUT TRAUMATIC AORTIC RUPTURE AND MYOCARDIAL CONTUSION: A CASE REPORT AND REVIEW

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Blunt thoracic trauma may lead to significant morbidity and mortality, and is often associated with other major systemic injuries. Aortic rupture and myocardial contusion are two of the more serious injuries which may result, and require rapid diagnosis and treatment. Fifty to eighty percent of patients with traumatic aortic rupture die before reaching the hospital; and of the remaining 20%, 72% progress to free rupture within eight days. Myocardial contusion has been shown to occur in 16% of blunt trauma victims in autopsy studies, but the true incidence is purely speculative as there is no gold standard for diagnosis. Multiple studies have proven the success of transesophageal echocardiography (TEE) in diagnosing aortic dissections and myocardial wall motion abnormalities, but few have addressed its use in traumatic aortic rupture and myocardial contusion.

We present the case of a 55-year old male victim of a high speed motor vehicle accident with injuries including a fractured sternum, ruptured sigmoid colon and femur fracture. Further, chest x-ray revealed a wide mediastinum. TEE was performed intraoperatively and revealed a completely normal descending thoracic aorta and normal myocardial wall motion. Post-operatively, no EKG changes or enzyme elevations were noted. The patient progressed well and was discharged home without further incident.

TEE can be rapidly performed in the emergency room, intensive care unit and operating room. Further, more and more anesthesiologists are becoming trained in its use and interpretation. A small number of case reports as well as a larger study of 11 patients have been published documenting TEE identification of aortic rupture. A second study showed TEE missed intimal tears, but correctly identified patients with myocardial contusions. In addition, these studies and others have documented good surgical outcomes in patients with myocardial contusion operated on for other traumatic injuries.

In conclusion, our case, along with the few others in the literature, support the use of TEE for diagnosis of traumatic aortic rupture and myocardial contusion. As TEE can be done more expeditiously and with less risk than currently employed diagnostic modalities, the need for a large, prospective study to evaluate the true diagnostic potential of TEE appears clear. It is clear, however, surgery can be safely and effectively performed in patients with myocardial contusion provided necessary monitoring and inotropic support are used.

LACTIC ACIDOSIS DURING ANESTHESIA FOR GRAFTING PROCEDURE IN EXTENSIVELY BURNED PATIENTS.

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Despite adequate respiratory and hemodynamic management, severely burned patients often develop metabolic acidosis during grafting procedure (GP). The aim of this study was to understand the underlying mechanisms of this acidosis. Because povidone-iodine (PI) may have contributed to this problem [2], a prospective, randomized study was designed.

Materials and Methods: After approval by the Ethic Committee of the hospital and informed consent, 16 extensively burned patients scheduled for GP were included prospectively in the present study. 2 groups of 8 patients were randomly assigned either to 4% povidone-iodine (betadine-scrub^R) or to 4% chlorhexidine, a non iodophor agent (Hibiscrub^R), as a topical antibacterial agent. Anesthesia was induced with propofol and maintained with isoflurane and fentanyl.

Arterial blood gases and temperature (T) were measured: before, 20, 60, 120 mn after induction and 1, 3 and 6 hours post-operatively. Arterial pressure and pulse rate, amount and nature of fluid replacement, duration of surgery, hemoglobin and Hematocrit, renal and liver function were also recorded before, during, and after surgery.

statistical methods: A Random numbers table gave blocks of 6 patients. All results are given as mean \pm sd. Comparisons were made using a Student t test for paired data. Quantitative data were analysed using a linear regression. A p value ≤ 0.05 was considered significant.

Results: Mean age was 32.4 ± 19 years and mean burned surface area (BSA) was $60 \pm 15\%$. All patients but 3 developed a significant acidosis: pH fell from 7.43 ± 0.05 to 7.33 ± 0.06 ($p < 0.001$). The base-excess fell from 0.86 ± 2.99 to -3.91 ± 3.64 mmol.l⁻¹ ($p < 0.001$).

There was a significant rise in blood lactate content: 1.50 ± 0.45 to 3.33 ± 1.53 mmol.l⁻¹ ($p < 0.01$), but the lactate/pyruvate ratio (L/P) did not raise.

There was no significant difference of pH between the 2 groups. Neither hypoxia or cetonemia, nor renal or liver dysfunction occurred, and only 2 factors were found to be correlated with pH:

$$(1) \text{ temperature: } \text{pH} = 0.046 T + 5.69 \quad r = 0.90 \quad (p < 0.001)$$

$$(2) \text{ number of red blood cell units transfused (RBCU): } \delta \text{pH} = -0.0178 \text{ RBCU} + 0.0082 \quad r = 0.67 \quad (p < 0.01)$$

Discussion: PI has been implicated in severe metabolic acidosis in burns with BSA greater than 20 % [2]. Acidosis seems to arise only with hypertonic formulas (ointments). Thus, even in extensive burns, PI seems to be adequate as a topical agent, provided the osmolarity of the solution remains low.

In extensively burns, despite (1) the use of a warming mattress, (2) an ambient temperature of 30°C and (3) warmed gazes and perfusions, a fall in body temperature (from 38.6 ± 0.5 to $35.7 \pm 1.1^\circ\text{C}$, $p < 0.001$), is unavoidable because of the important skin defect. Hypothermia is known to produce lactic acidosis unrelated to cellular hypoxia as attested by conservation of L/P ratio [1].

The correlation with RBCU seems to be due to the presence of undesirable acid compounds because no one correlation was found between RBCU and T fall, nor with anemia or cardiovascular collapse.

Conclusion: During GP, transient hypocapnia may be desirable to correct acidosis, since pH spontaneously rises back with the reversal of hypothermia [3].

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EIGHT MONTHS EXPERIENCE OF ACUTE LUNG INJURY IN A MULTIDISCIPLINARY ICU

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INTRODUCTION: Murray et al (1) has recently expanded and clarified the definition of acute lung injury (ALI) and ARDS. We used this definition to evaluate ALI in our ICU.

AIM: A descriptive, prospective study of all adult patients with ALI admitted to a multidisciplinary ICU.

METHOD: All adult patients for a 8 month period, excluding those with primary heart disease, fluid overload and chronic interstitial lung disease, were entered into the study and categorised on admission according to initial diagnosis. Other demographic data was recorded. All patients were assessed daily for ALI, sepsis syndrome (2), shock, organ failure and DIC. The end point of the study was ICU discharge or death.

RESULTS: During the study period 295 adults were admitted to the unit. Of the 143 patients (62 ♀ and 81 ♂; mean age 35; mean Apache II 19) fulfilling the criteria, 83 (47 on admission) developed ARDS (ALI ≥ 2.5) with a mortality of 45%. Patients with ARDS had a higher mortality than that predicted by Apache II (45% vs 39%) whereas those with mild to moderated ALI had a mortality that correlated better with predicted (38% vs 38%). Of the 36 patients who developed ARDS in the unit, 21 (58%) died. Other organ failure associated with ARDS increased mortality dramatically (0-22%, 1-53%, 2-69% and ≥ 3 -100%). Only 2 patients with ALI had an initial diagnosis of aspiration pneumonia and no patient was diagnosed as having drug induced ALI. (Other admission diagnoses will be presented). Of the 103 (72%) patients who had the sepsis syndrome, 59 had ARDS with a mortality of 58% and 34 had septic shock with a mortality of 66%. Of the 24 (17%) patients who had DIC, 12 developed ARDS of which 10 (83%) died.

CONCLUSIONS: In our young, severely ill patients, ALI has a high morbidity and mortality which significantly rises with other associated organ failure. Our high mortality of 45% in ARDS correlates with other studies. As a cause of ALI we report a much lower incidence of aspiration and a higher incidence of sepsis syndrome.

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BLUNT INJURY OF THE INTERNAL CAROTID ARTERY IN TRAUMA PATIENTS

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Blunt trauma of the carotid artery leading to dissection of the vessel wall are considered to be very rare (1). The diagnosis is commonly performed, after a symptom free delay, on the appearance of neurological symptoms related to thrombosis of the artery or to emboli. Such a diagnosis is especially difficult in multiple trauma patients. We report four cases of carotid trauma associated with head facial or cervical fractures in such patients. The 4 patients were victims of auto crash. All were initially in coma and suffered of either petrous (2 cases) transverses processes of C2 (1 case) or mandibular (3 cases) fractures. In the first three cases, hemiplegia or worsening of the neurological status occurred within a delay of 24 to 48 hours. A CT scan documented multiple infarcts in 2 cases and a massive hemispheric infarction in one case. The diagnosis was confirmed by angiography which showed a dissection of both internal carotid arteries (ICA) in two cases located at the base of the skull and of the intracranial ICA in one case. A false aneurysm of the ICA developed in 2 cases. One patient died the two others recovered with important neurological aftermaths under anticoagulant. Doppler examination was performed in the 4th patients because of a bilateral petrous fracture. The diagnosis, suspected by Doppler (increased velocity in the ICA) was confirmed by angiography who documented bilateral dissection of the intracranial ICA with a false aneurysm. Heparin was administered to this patient who never documented emboli or thrombus after angiographic control and recovered without aftermath.

These 4 cases point out the difficulty of early diagnosis and the need of preventive treatment in multiple trauma patients and suggest that Doppler examination might be performed in patients with petrous mandibular or cervical fractures.

Reference :

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ARDS FOLLOWING MULTIPLE TRAUMA - DOES KINETIC POSITIONING REPRESENT A CRUCIAL SUPPORTIVE TREATMENT STRATEGY?

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PURPOSE: The posttraumatic adult respiratory distress syndrome (ARDS) is still associated with a high mortality. Despite various efforts a therapeutical breakthrough to diminish interstitial edema has not been achieved. In several cases of severe ARDS we have seen improvements of lung function by means of continuous body positioning. We therefore compared the effect of kinetic positioning (KIN) on lung function and hemodynamics in ARDS patients to conventional (CON) supine positioning.

METHODS: ARDS patients with multiple trauma treated by supportive continuous body positioning (ROTOREST[®], KIN) and without continuous positioning (CON) were investigated daily. Pulmonary and systemic hemodynamics were determined on the basis of pulmonary artery catheter measurements. The oxygenation ratio ($\text{PaO}_2/\text{FiO}_2$) and the pulmonary shunt ($\text{Qs}/\text{Qt},\%$) were calculated. Extravascular lung water (EVLW,ml/kgbw) was determined by double indicator thermodilution technique for determination of pulmonary edema. Stat: paired/unpaired T-test, $p<0.05$.

RESULTS: 22 patients were included. The mean age was comparable (35 ± 13.5 years (KIN) ($n=11$); 38.8 ± 16.6 years (CON) ($n=11$)). Total injury severity by injury severity score (ISS) was 29.6 ± 6 points (KIN) and 31.6 ± 5 points (CON). Deaths: KIN $n=6$; CON $n=9$. Deaths from ARDS: KIN $n=2$ CON $n=7$. The oxygenation ratio ($\text{PaO}_2/\text{FiO}_2$) increased significantly from 140 ± 45 (day 0) to 237 ± 40 ($p<0.05$) (day 5) (KIN), in CON patients no improvement (143 ± 48 (day 0), 133 ± 44 (day 5)) was seen ($p<0.05$ between groups). Pulmonary shunt decreased significantly from $26.6\pm4\%$ (day 0) to $12.5\pm2\%$ (day 5) ($p<0.002$) in KIN patients and was $36.6\pm6\%$ at day 0 and $31.4\pm2\%$ at day 5 in CON patients ($p<0.05$ between groups). EVLW was 11.1 ± 2 ml/kgbw at day 0 and 9.4 ± 1 ml/kgbw at day 5 (KIN) - EVLW was 12.9 ± 2 ml/kgbw at day 0 and 17.4 ± 3 ml/kgbw at day 5 (CON) (not significant). There were no significant changes of systemic hemodynamics between the groups or compared to day 0.

CONCLUSIONS: 1. -In ARDS-patients submitted to body positioning oxygenation improves significantly and is significantly better compared to those with conventional supine positioning. 2. The improvement of lung function might be due to less formation of interstitial pulmonary edema (EVLW) and less ventilation/perfusion mismatch (Qs/Qt). 3. Continuous body positioning does not alter systemic hemodynamics. 4. Continuous body positioning is a promising supportive treatment regimen in posttraumatic ARDS.

INTERPLEURAL REGIONAL ANALGESIA IN THE PAIN MANAGEMENT OF CHEST TRAUMA

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The effects of interpleural regional analgesia (IPA) in chest trauma patients were studied. And further studies were carried out to determine whether the patient's positioning and the injected portion of anesthetics influence the effects of IPA.

Twelve chest trauma patients with severe pain were studied. All of them had multiple rib fracture, hemopneumothorax or pulmonary contusion, and needed the continuous chest drainage. 16G epidural block catheter was inserted 20cm into the apex of the pleural space in all patients. Furthermore, another epidural catheter was placed into the base of the pleural space in five patients. After injecting 10ml of 1% lidocaine, the analgesic effect, the analgesic range by injected portion (apex or base), and the change of vital signs, PaO₂/FI O₂ and PaCO₂ were evaluated. On the otherhand, 99mTcO₄- 370MBq (10mCi)/10ml of saline was injected and observed it's distribution in the pleural space.

The average of the pain scale before the IPA was 2.9 and 1.0 point after the 15min. And the return to pre-IPA condition took about 150min. The mean blood pressure did not indicate significant changes, although pulse rate and respiratory rate decreased slightly 15min after the IPA. PaCO₂ did not change significantly, although PaO₂/FI O₂ increased.

Apex catheter: In the supine position, the range of hypesthesia was between Th2.5 to Th10.3, but in the sitting position, between Th5.5 to Th10.2. In the supine position, radioisotope (RI) was all accumulated in the pleural space, but in the SPECT (single photon emission computed tomography) view, RI was focused at the interpleural dorsal side. In the prone position, RI was focused at the interpleural abdominal side.

Base catheter: In the supine position, the range was between Th 5.8 to Th11.0, and RI did not accumulate into the upper portion of the interpleural space.

The present study indicated that the IPA to chest trauma have the effects for pain relief and the significant improvement of arterial blood gas without circulatory changes. It was reported that effective pain relief was not experienced after thoracotomy. However, when the catheter was placed at the apex of the pleural space, it seemed to be effective to the chest site. The results of the RI distribution revealed that the anesthetics would be influenced by gravity. Therefore, the catheter should be inserted into the apex of the pleural space and anesthetics should be administered in the supine position.

In conclusion, IPA seems to be simple, effective and useful for chest trauma patients in the condition which the epidural block was difficult to induce.

AIRWAY MANAGEMENT WITH PENETRATING NECK TRAUMA: A RETROSPECTIVE STUDY

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We could find no large studies of airway management with penetrating neck trauma, only anecdotal reports. Controversy exists among experts as to the safest method of intubating these patients. In general, our preference in management of these airways has been by rapid sequence induction and intubation by direct laryngoscopy. We now present our retrospective results and outcome in managing these airways.

Through the Trauma Department Quality Assurance records we identified those patients with penetrating neck trauma who were to be taken to surgery over the past two years. The hospital records of these patients were reviewed.

The following variables were analyzed and compared: 1. Intubation technique: direct laryngoscopy, blind nasal, fiberoptic, and surgical intubation. 2. Type of injury: Gunshot, stab wounds, and other. 3. Zone of the injury.

We studied 107 patients with penetrating neck wounds; 36 gunshot wounds, 63 knife wounds, and eight wounds classified as other. Type of injury or zone of injury did not correlate with the difficulty of airway management. Two patients died; one of his wounds and the other due to loss of his airway caused by a failed attempt at blind nasal intubation. Six subjects (6%) received a surgical airway as the primary choice, and two (2%) as an emergency airway. These patients tended to be hemodynamically unstable $p < 0.01$. The success rate with the various intubation techniques is presented in the Table.

| | BLIND | | DIRECT | | FIBEROPTIC | | OVERALL | |
|-----------|-------|-----|--------|-----|------------|-----|---------|-----|
| | N | % | N | % | N | % | N | % |
| DIFFICULT | 1 | 25 | 15 | 17 | 1 | 13 | 17 | 17 |
| EASY | 3 | 75 | 74 | 83 | 7 | 87 | 84 | 83 |
| SUCCESS | 3 | 75 | 87 | 98 | 8 | 100 | | |
| FAILURE | 1 | 25 | 2 | 2 | 0 | 0 | | |
| TOTAL | 4 | 100 | 89 | 100 | 8 | 100 | 101 | 100 |

We found that the success rate of rapid sequence induction and direct laryngoscopy was 98%. Although the fiberoptic success rate was 100% the number of subjects in this group was insufficient to make any comparison or recommendations. We strongly recommend against the use of an indirect blind technique for intubation. We believe that the intubation techniques of choice for these patients are either direct laryngoscopy or a surgical airway depending on the patient's presentation.

THE BECK AIRWAY AIRFLOW MONITOR (BAAM^R) DISTINGUISHES TRACHEAL FROM ESOPHAGEAL INTUBATION

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Although it is essential to correctly place an endotracheal tube in the trachea, not the esophagus, during resuscitation from cardiac arrest, accurate determination of intratracheal endotracheal tube placement is difficult in the patient with ongoing cardiac arrest. Many strategies have been devised to differentiate esophageal from tracheal ventilation; however, the presence of a characteristic exhaled CO₂ wave form has become the "gold standard" to identify correct intratracheal position of the endotracheal tube. Cardiac arrest causes a marked diminution or actual cessation of pulmonary CO₂ excretion and, therefore, renders the exhaled CO₂ waveform useless to differentiate tracheal from esophageal endotracheal tube placement. We have tested the BAAM, a device that emits a whistle from air expelled through an endotracheal tube, to distinguish tracheal from esophageal endotracheal tube placement.

Materials and Methods. Thirty patients receiving general anesthesia or prolonged mechanical ventilation whose endotracheal tubes were previously confirmed to be correctly placed in the trachea were evaluated to ascertain the number of times the BAAM would emit a characteristic whistle when the upper chest and subxyphoid abdomen were gently percussed after they were briefly disconnected from the breathing circuit and the BAAM was placed over the endotracheal tube connector. Another group of anesthetized, spontaneously breathing patients were evaluated to ascertain the number of times the BAAM would emit a characteristic whistle when an endotracheal tube was placed in the esophagus while the chest and upper abdomen were gently percussed with the BAAM placed over the end of the tube. All of the esophageally intubated patients were breathing spontaneously through their native airways when tested for the BAAM function.

Results. All of the endotracheally intubated patients emitted a characteristic whistle with a gentle push over both the upper chest wall and the subxyphoid region of the abdomen. The spontaneously breathing anesthetized patients, who had an endotracheal tube placed only in the esophagus, failed to emit a whistle either with a chest percussion or with spontaneous respiration. One patient with a large gastric air bubble emitted a whistle with a subxyphoid percussion.

In Summary, correct intratracheal placement of an endotracheal tube is identified by a whistle emitted from the BAAM with exhaled gas flow generated by chest percussion. Conversely, no whistle is generated by direct percussion if the endotracheal tube is esophageally placed. The BAAM can be used as an adjunct to exhaled CO₂ waveforms to identify correct endotracheal tube placement especially in trauma patients with cardiac arrest who have no pulmonary CO₂ excretion.

TRANSTRACHEAL HIGH FREQUENCY JET VENTILATION FOR EMERGENCY AIRWAY MANAGEMENT

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High Frequency Jet Ventilation (HFJV) can be successfully applied with a 14g needle by cricothyroid membrane puncture. It has the advantage that it does not require general anesthesia nor muscle relaxation for intubation and at frequencies above 100 per minute is capable of preventing aspiration. It offers a fast alternative to difficult intubation in an emergency situation.

In the last several years, the method has been successfully used at Montefiore University Hospital for emergency airway management in 69 patients. In all of these patients, cricothyroid membrane puncture was performed under local anesthesia with a 14 gauge Angiocath (R) catheter in the emergency room, operating room or intensive care unit, and the catheter immediately connected to a high frequency jet ventilator for respiratory support.

There were 18 patients with orofacial trauma or with abscesses and infections compromising the airway, 9 ENT patients with upper airway pathology and 12 patients with acute respiratory distress. In the other 30 patients, unexpected failed intubation or anatomically abnormal upper airway was the indication for transtracheal ventilation. The method not only prevented aspiration of blood, secretions and/or pus, but was even able to dislodge upwards a foreign body impacted between the vocal cords. All patients had then successful definite surgical treatment or permanent airway established by tracheostomy or fiberoptic intubation while they were ventilated by HFJV.

The method has an additional advantage, namely, it permits intrapulmonary application of drugs without interruption of ventilation. This was demonstrated in a study performed in dogs to evaluate whether resuscitative drugs could be administered via a transtracheal catheter by high frequency jet ventilation (HFJV) to achieve intrapulmonary dispersion and hopefully rapid absorption into the bloodstream. A total of 16 experiments were performed on anesthetized dogs. In 8 dogs with intact circulation and in 3 dogs with asphyctic cardiovascular collapse, hemodynamic responses were studied after administration of epinephrine and/or atropine during HFJV. In additional 5 dogs, radioisotope studies were performed to evaluate the distribution of a tracer administered into the jet.

Intravenous administration of 0.05 mg/kg of epinephrine or atropine produced a hemodynamic response after 10 sec. as opposed to 20 sec. after intrapulmonary administration. The dose administered by intrapulmonary route had to be twice or three times as large as the IV dose to get an adequate response, but the duration of the hemodynamic response was prolonged up to 20 min. after intrapulmonary administration. Radioactive tracer administered via cricothyroid catheter during jet ventilation was distributed fast and uniformly. The circulatory uptake was rapid. In 12 sec. after administration, the distribution in the lung fields and in the cardiac blood pool was visualized indicating that the drug was already in the blood stream. When, on the other hand, the isotope was administered through an endotracheal tube, the distribution was significantly slower and most of the isotope remained in the area of the endotracheal tube.

In conclusion, HFJV was successfully used on a series of patients to secure the airway and deliver respiratory support in upper airway emergencies. Cricothyroid membrane puncture with high frequency jet ventilation or oxygen administration should be considered an important alternative for emergency airway management. Results of experimental study performed indicate that HFJV permits intrapulmonary application of drugs without interruption of ventilation.

**RESOURCE UTILIZATION FOR PENETRATING TRAUMA TO THE TORSO
IN DALLAS COUNTY, TEXAS**

D.J. Reinhart, K.W. Klein, A.H. Giesecke, C. Kelly, K. Boyle, W.C. Stegall, B. Courtney
Department of Anesthesiology, Univ of Texas, Southwestern Med Ctr, Parkland Memorial
Hospital, Dallas, Texas, United States.

Purpose: Physical trauma is the principal cause of death among Americans between the ages of one and thirty-eight, and nonaccidental trauma is the fifth leading cause of death in the United States. Approximately 165,000 people die each year, and more than \$87 billion per year is spent as a result of traumatic injuries in the country. Trauma patients occupy 12% of the hospital beds in the United States. The increasing number of nonaccidental traumatic injuries has prompted many to analyze the morbidity and mortality, as well as the economic implications, associated with the use of firearms. Some physicians have called for legislators to consider bills restricting the availability of firearms, while others believe that all guns should be banned. Parkland Memorial Hospital is one of the largest trauma centers in the country, and a large proportion of injuries seen there are the result of penetrating injuries inflicted by firearms and knives. The purpose of this study is to compare the monetary costs and utilization of hospital resources of gunshot wounds and stab wounds.

Methods: The hospital records of 273 consecutive patients with penetrating trauma to the chest or abdomen were reviewed to determine the cost and utilization of hospital resources in a major trauma center. The study began February 1, 1986 and within four months, 300 patients with penetrating trauma to the chest or abdomen were seen. Data continued to be collected through June 1989 to establish how long each patient required continuing medical follow-up after being discharged.

Results: The majority of patients were black males (53%), 75% were unemployed, and 90% had no insurance. The average cost of hospitalization per patient was \$6680.22 for gunshot wounds and \$2558.13 for stab wounds. Victims of gunshot wounds required significantly more blood, more crystalloid solution, longer hospitalization, more consultations, more surgery, and longer follow-up than patients who were stabbed.

| | Requiring <u>Hospitalization</u> | Requiring <u>Surgery</u> | Avg. Days <u>Hospitalized</u> | Avg. ICU <u>Days</u> | Other <u>Injuries</u> |
|-----|-------------------------------------|-----------------------------|----------------------------------|-------------------------|--------------------------|
| SW | 142(79%) | 67(37%) | 2.74 | 0.17 | 49(27%) |
| GSW | 84(90%) | 54(58%) | 5.68 | 0.77 | 32(34%) |

| | Avg. RBC <u>Units</u> | Avg. Amt. of <u>Crystalloid</u> | Avg. Trauma <u>Score</u> | Avg. No. <u>Consults</u> | Follow-up <u>Time</u> | <u>Expired</u> |
|-----|--------------------------|------------------------------------|-----------------------------|-----------------------------|--------------------------|----------------|
| SW | 0.84 | 2048cc | 15 | 0.82 | 1.5wks | 7(4%) |
| GSW | 2.16 | 2230cc | 13 | 1.32 | 7.0wks | 19(20%) |

The majority of patients were young black males. Thirteen percent of the patients in this study were assaulted by relatives or acquaintances. Only 25% of the victims were employed, which probably accounts for the small number of patients with commercial insurance (6%). In instances where the penetrating trauma occurred in conjunction with another crime, guns were responsible over twice as often as knives.

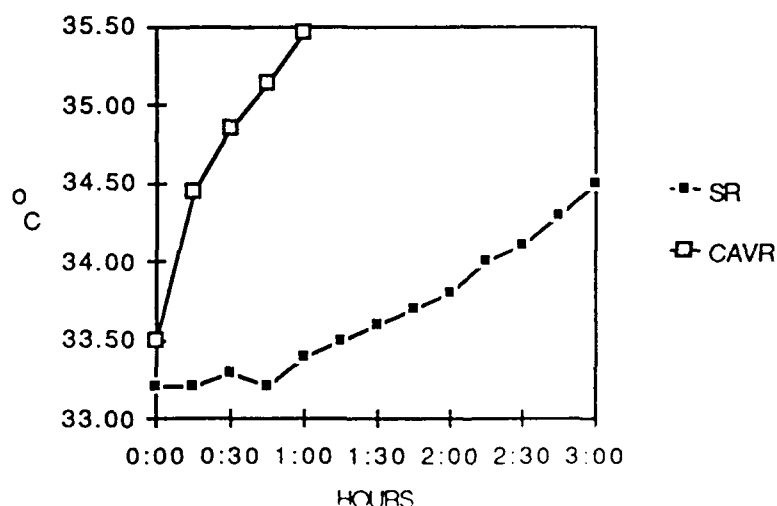
Conclusions: The results indicate that penetrating trauma to the torso consumes significant community resources, with gunshot wounds accounting for the larger expenditure. Public sources paid more than \$900,000 for the injuries occurring in this 4-month study. If this study had included injuries to the head and/or the extremities, the total expense would have been greater. Gunshot victims cost Dallas county an average of \$6,000 each, which is greater than twice the amount public sources pay for people who are stabbed.

CONTINUOUS ARTERIOVENOUS REWARMING (CAVR): RAPID REVERSAL OF HYPOTHERMIA IN CRITICALLY ILL PATIENTS

L.M. Gentilello, R.A. Cobean, P.J. Offner, R.W. Soderberg, G.J. Jurkovich. Department of Surgery, Harborview Medical Center, University of Washington, Seattle, WA, U.S.A.

The mortality rate of critically ill patients correlates directly with both the degree and duration of postoperative hypothermia. However, such patients can be extremely difficult to treat using standard rewarming (SR) techniques. We developed a rewarming method (CAVR) that is significantly faster than SR. The tubing circuit of a counter-current fluid warmer designed for rapid warming of IV fluids was heparin bonded, and percutaneously placed femoral arterial and venous hemofiltration catheters were connected to its inflow and outflow side, creating a circulatory fistula through the heating mechanism. We report the first clinical trial using this technique.

Over a ten month period 34 patients were treated for hypothermia ($T < 35^{\circ}\text{C}$) after major trauma ($n=23$), ruptured aortic aneurysm ($n=7$), bleeding varices ($n=2$), near drowning ($n=1$) or perforated ulcer ($n=1$). Eighteen patients received SR only, which consisted of combined use of airway rewarming, heating blankets, warm IV fluids, a Mylar head wrap and a radiant heat shield. CAVR was added to SR in the remaining 16 patients. Both groups had equivalent APACHE II, Injury Severity and Acute Physiology Scores, and prewarming blood and fluid requirements and incidence of coagulopathy were similar.



Results: Hypothermia resolved in 39 minutes with CAVR vs. 3.23 hours with SR ($p < 0.0001$). This was associated with a significant reduction in blood and overall fluid requirements, number of organ failures, and length of ICU stay, and a significant increase in survival after moderately severe injury.

Conclusion: CAVR achieves simple, percutaneous extra-corporeal rewarming without the need for heparin or pump assistance, is significantly faster than SR, and results in rapid correction of the pathophysiologic changes associated with hypothermia.

USE OF PERMISSIVE HYPERCARBIA TO REDUCE MINUTE VENTILATION IN PATIENTS WITH POST-TRAUMATIC ARDS COMPLICATED BY SEVERE BAROTRAUMA

W.S. Brosche, J.K. Stene, M.T. Snider. Department of Anesthesia, Pennsylvania State University College of Medicine, Hershey, PA USA

The ventilatory management of patients with post-traumatic ARDS is frequently complicated by pulmonary barotrauma that limits the tidal volume and airway pressures that the patients tolerate. We have adopted a technique of metabolically altering the patients' blood bicarbonate levels to allow a markedly elevated PaCO₂ with a normal pH_a. Because the gradient for CO₂ removal is enhanced by increasing PaCO₂ and PACO₂, the patients' minute CO₂ production can be excreted with a decreased minute ventilation while maintaining an adequate PAO₂ and preventing arterial hypoxia.

The technique involves various manipulations to accelerate renal compensation including administration of exogenous sodium bicarbonate, diuresis with furosemide, nasogastric suction and replacement of chloride with acetate in parenteral nutritional formulations.

Permissive hypercarbia was achieved in five patients suffering from post-traumatic ARDS with associated barotrauma, two of which also underwent IVOX therapy:

Table: Changes in Respiratory Parameters with Permissive Hypercarbia

| Parameter | fiO ₂ | PIP cm H ₂ O | V + ml | PEEP cm H ₂ O | Rate breaths per min | V _M l/min | pH | PaO ₂ mmHg | PaCO ₂ mmHg | HCO ₃ meq/l | BE | Na meq/l | Cl meq/l | SaO ₂ % |
|-------------------------|------------------|-------------------------|-----------|--------------------------|----------------------|----------------------|--------------|-----------------------|------------------------|------------------------|-------------|-----------|----------|--------------------|
| Mean Initial Values | .90 ± .2 | 64.2 ± 17.3 | 586 ± 197 | 13.4 ± 9.0 | 32.8 ± 18.1 | 18 ± 9 | 7.37 ± .08 | 116 ± 59 | 57 ± 11 | 32.6 ± 1.6 | 6.4 ± 1.8 | 139 ± 6 | 98 ± 6 | 97 ± 2 |
| Mean Hypercarbic Values | .65 ± .1 | 41.2 ± 9.9 | 340 ± 96 | 6.9 ± 5.7 | 34.4 ± 10.8 | 11 ± 3 | 7.376 ± .02 | 77.6 ± 20 | 82 ± 17 | 51.7 ± 5.2 | 19.8 ± 6.7 | 150 ± 6 | 92 ± 5 | 94 ± 5 |
| Mean ▲ | .25 ± .2 | 23 ± 17.3 | 246 ± 210 | 6.5 ± 5.0 | -1.6 ± 20.6 | 7 ± 11 | -0.006 ± .09 | 38.4 ± 49 | -25 ± 17 | -16.7 ± 10.5 | -11.4 ± 3.8 | -10 ± 8.5 | 6 ± 3 | 3 ± 3 |

n = 5 † = p < .05

Mean ▲ (Initial - Hypercarbia)

This hypercarbic state allowed a significant reduction in peak inspiratory pressures, positive end expiratory pressures, as well as a reduction tidal volume and moderate reduction in minute ventilation. PaCO₂, bicarbonate levels and base excess were significantly increased while maintaining pH_a and PaO₂. Two of the patients healed large bronchopleural fistulae with this technique and were discharged from the hospital. The other three patients died from septic complications of their trauma.

Permissive hypercarbia thus appears to be a reasonable technique in patients with post-traumatic ARDS complicated by barotrauma to decrease the high ventilatory pressures seen in these patients to allow for healing and to prevent possible further lung injury.

CARDIOPULMONARY CHANGES DURING PROSTHETIC HIP SURGERY WITH ACRYLIC BONE CEMENT EVALUATED BY MEANS OF TRANSOESOPHAGEAL ECHOCARDIOGRAPHY (TEE).

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¹ Department of Anaesthesia and General Intensive Care

² Department of Traumatology

University of Vienna, A-1090 Vienna, Austria

Introduction: Acrylic bone cement in prosthetic hip surgery frequently triggers pathophysiologic events. More specifically, a correlation between the use of acrylic bone cement and cardiorespiratory changes has been observed [1]. The aim of our study was to analyze the hemodynamic and pulmonary changes during surgery.

Patients and methods: 7 patients (ASA 3-4), average age 87 (81-91) years were studied. In all patients a central venous catheter was inserted and the arteria radialis was cannulated. Anaesthesia, fluids (Ringer's Solution) and catecholamine support (dopamine up to 10 µg/kg/min) was given according to a standard protocol. Patients were normoventilated with an oxygen/nitrous oxide mixture (FiO₂ 0.5). After induction of anaesthesia, the TEE probe was positioned and measurements of cardiac output (CO), ejection fraction (EF) and enddiastolic and endsystolic volume (EDV, ESV) were performed. In addition, partial pressure of oxygen and carbon dioxide (pO₂, pCO₂), systolic and mean arterial pressure (SAP, MAP) and heart rate (HR) were documented ten minutes after induction (A), immediately after implantation of bone cement (B0), then every 2 minutes (B2, B4, B6) and at the end of surgery (C).

Results: As shown in the table 6 minutes after cement implantation a decrease in MAP and EF and an increase in RAP was observed, whereas only slight changes were seen in HR, pO₂ and pCO₂.

| | | A | B0 | B2 | B4 | B6 | C |
|------------------|-----------|----------|----------|----------|----------|----------|----------|
| HR | beats/min | 86±6.2 | 86±5.9 | 87±6.3 | 84±6.1 | 81±4.9 | 77±3.7 |
| MAP | mmHg | 94±4.0 | 99±7.8 | 95±5.1 | 87±2.9 | 80±3.0* | 83±3.8 |
| RAP | mmHg | 8±1.6 | 10±1.6* | 11±1.6* | 10±1.4 | 10±1.3* | 10±1.6 |
| pO ₂ | mmHg | 159±16 | 161±8.2* | 140±9.3 | 143±11.3 | 142±10.3 | 139±8.4 |
| pCO ₂ | mmHg | 39±1.0 | 37±1.6 | 38±1.6 | 38±1.6 | 39±1.7 | 40±2.2 |
| CO | l/min | 3.7±0.49 | 4.4±0.72 | 3.2±0.31 | 4.1±0.75 | 3.8±0.60 | 4.2±1.02 |
| EF | % | 43±7.1 | 40±6.4 | 42±3.3 | 42±3.7* | 40±4.0* | 47±5.7 |

* p < 0.05 compared to A (Wilcoxon Test for matched pairs)

TAB.: mean ± SEM

Conclusion: In our patients cardiorespiratory changes occurred during cemented hip surgery. However, with the monitoring used hemodynamic changes could be treated satisfactory, although a poor cardiac performance was seen already at baseline measurements.

References: 1) Hyderally H., Miller R.: Hypotension and cardiac arrest during prosthetic hip surgery with acrylic bone cement. Orthop. Rev. 5: 55 (1976)

Level One Trauma Anesthesia Simulations (LOTAS)

Moderator in Chief: Colin F. Mackenzie, M.D.

This session will focus on various aspects of the Level One Trauma Anesthesia Simulations (LOTAS) project. The session will discuss progress in videoanalysis of trauma anesthesia personnel at a Level One Trauma Center. The techniques, equipment and software used will be described. Performance and human factors issues will be presented.

BREAKAWAY SESSION

Simulation of Level One Trauma Anesthesia

Colin F. Mackenzie, M.D.

Part One

Thursday June 11 2:30-3:30 p.m.

I. Introduction to Anesthesia simulators and training devices

A. Existing simulators and training devices

1. 1968 Denison and Abrahamson (SIMI) - Training device
2. 1972 Smith N.T. (SLEEPER) - simulator
3. 1987 Schwid (SIMCORD - simulator
4. 1988 Gaba (CASE) simulator
5. 1988 (GAS) simulator

II. Pharmacological and physiological modelling

III. Simulators and training devices relevant to trauma anesthesia

A. Trainers

1. Intubation trainers
2. Fiberoptic bronchoscopy models
3. IV insertion models

B. Simulators

1. SLEEPER
2. SIMCORD
3. CASE
4. GAS

- A. Anesthetic Uptake and Distribution
- B. Onset and duration neuromuscular blockade
- C. Cardiorespiratory physiology
- D. Thermoregulation
- E. Renal function
- F. Respiratory

BREAK - 4:00-5:30 P.M.

Part Two

I. Video Analysis of Trauma Resuscitation and Anesthesia

A. Video Analysis

- 1. Equipment
- 2. Techniques and Requirements to get started

B. Equipment

- 1. Cost
- 2. Type
- 3. Placement

C. Video Analysis

- 1. Software
- 2. Cost
- 3. Equipment needed

II. Consent issues related to vide analysis

III. Video analysis of trauma resuscitation and anesthesia

A. Presentations by Delegates

- 1. Maryland Institute for Emergency Medicine

1. Maryland Institute for Emergency Medicine
2. Hadassah University Hospital
3. Birmingham Accident Hospital
4. Bristol Royal infirmary
5. SAMU Paris

PLENARY SESSION III

Moderator: Wolfgang F. Dick, M.D., Ph.D., FFARCS (Hon)

New Aspects of Resuscitation

Peter Safar, M.D.

Perioperative Anesthesia Management of Head Injuries

Elizabeth A. M. Frost, M.D.

Perioperative Anesthesia Management of Thoracic Injuries

Leland H. Hanowell, M.D.

Panel Session: Questions and Answers

Wolfgang F. Dick, M.D., Ph.D., FFARCS (Hon) and Faculty

NEW ASPECTS OF RESUSCITATION OF THE SEVERELY TRAUMATIZED PATIENT

Peter Safar, M.D.

I. Definitions

- A. Terminal State/Clinical Death
- B. Protection-Preservation-Resuscitation

II. Lethal Hemorrhagic Shock

- A. Self-Resuscitation
- B. Fluid Resuscitation

III. Standards and Guidelines

- A. Life Supporting First Aid (i.e., Basic Trauma Life Support).
- B. Advanced Trauma Life Support
- C. Modification of 3 phases and 9 steps of Cardiopulmonary Cerebral Resuscitation (CPCR), for victim of potentially lethal polytrauma.
- D. Relevance for Traumatology of American Heart Association (AHA) CPR Emergency Cardiac Care (ECC) Guidelines Changes of 1992.

IV. Exsanguinating Hemorrhage (including rapid infusion system,

RIS)

V. Emergency Cardiopulmonary Bypass (CPB)

VI. Suspended Animation (to enable otherwise infeasible resuscitative surgery)

VII. Resuscitation from Severe Cerebral Trauma

- A. Prehospital Life Support
- B. Hypothermia
- C. Anesthetic Management
- D. Pharmacologic and Fluid Therapy
- E. Intensive Care
- F. Outcome Prediction
- G. Research

PERIOPERATIVE ANESTHETIC MANAGEMENT OF HEAD INJURIES

Elizabeth A.M. Frost, M.D.

- I. Extent of the Problem
- II. Epidemiology
- III. Demographics
- IV. Types of Injuries
- V. Emergency Care
 - A. Respiratory Assessment (therapy of hypoxia and hypercarbia)
 - B. Control of Raised Intracranial Pressure
 - C. Cardiac Assessment (treatment for hypotension, hypertension and dysrhythmias)
 - D. Neurologic Assessment
 - E. Coagulopathies (diagnosis and treatment)
 - f. Neurologic Testing: Anesthetic Management
- VI. Anesthetic Management
 - A. Establishment of the Airway
 - B. Choice of Agents
 - C. Monitoring
 - D. Fluid Therapy
- V. Postanesthetic Care
 - A. Hemodynamic Stabilization
 - B. Time of Extubation

VI. Intensive Care

A. Non-operative Care

B. Monitoring:

1. Systemic Pressure
2. Intracranial Pressure
3. Electrophysiologic Monitoring

C. Hyperalimentation

D. Brain Protection

PERIOPERATIVE MANAGEMENT OF THORACIC INJURIES

Leland H. Hanowell, M.D.

I. Introduction: The first 24 hours

- A. Introduction/Epidemiology
- B. Preoperative Assessment: Thoracic
 - 1. Examination
 - 2. Radiographs
 - 3. Placement of Chest Tubes
- C. Tube Thoracostomy for Thoracic Trauma
- D. Trauma Operating Room Preparations
- E. Hypothermia
- F. Preoperative Assessment of the Airway

II. Anesthesia for Thoracic Trauma

- A. Induction of Anesthesia for Thoracic Trauma
- B. Neuromuscular Relaxation
- C. Awareness During Anesthesia
- D. Inhaled versus Intravenous Anesthesia
- E. Management of Open Chest Resuscitation
- F. Mechanical Ventilation of the Non-Compliant Lung
- G. Perioperative Hemodynamic Instability/Monitoring
- H. Placement of Double Lumen Endotracheal Tubes
- I. One Lung Anesthesia
- J. Hypoxic Pulmonary Vasoconstriction

III. Fluid/Blood Administration for Thoracic Trauma

- A. Colloid or Crystalloid
- B. Rapid Infusion of Blood Products
- C. Intraoperative Autotransfusion

IV. Perioperative Complications

- A. Coagulation Abnormalities
- B. Disseminated Intravascular Coagulation
- C. Adult Respiratory Distress Syndrome

V. Thoracic Trauma

- A. Bronchial Tears, Tracheal Disruptions, Bronchopleural
Fistulae
- B. Air Embolism Complicating Chest Trauma
- C. Flail Chest
- D. Airway Obstruction by Foreign Body

VI. Thoracic Aortic Trauma

- A. Anesthetic Management for Thoracic Aortic Trauma
- B. Coordination of Anesthesia and Surgery During Aortic
Repair
- C. Spinal Cord Injury Associated with Thoracic Aortic Repair
- D. Left Heart Bypass for Repair of Thoracic Aortic Trauma

VII. Cardiac Injuries

- A. Cardiac Tamponade
- B. Cardiac Contusion
- C. Myocardial Injuries

VIII. Thoracoabdominal Injuries

- A. Diaphragmatic Rupture
- B. Injury to the Spleen
- C. Liver Laceration
- D. Intestinal Trauma
- E. Pancreatic and Retroperitoneal Trauma

IX. Early Postoperative Care

- A. Diaphragmatic Dysfunction
- B. Newer Modes of Mechanical Ventilation
- C. Incentive Spirometry/Postoperative Bronchodilators

X. Pain Management for Thoracic Trauma

- A. Epidural Analgesia
- B. PCA - Patient Controlled Analgesia
- C. Interpleural and Intercostal Blocks

XI. Conclusions

Airway Management for Trauma

Moderator in Chief: Elizabeth C. Behringer, M.D.

Moderators : Kenneth J. Abrams, M.D.

Charles R. Barton, CRNA

Elizabeth A. M. Frost, M.D.

Mark T. Murphy, M.D.

Ann J. Sutcliffe, BSc, FFARCS, LRPS

This session will begin with representative case presentation of controversial issues such as shotgun wounds of the face, facial fractures, the "wired jaw," spinal ankylosis, laryngeal injury, penetrating neck wounds, tracheostomies, intrathoracic airway trauma, and the use of special management techniques. Audience participation is emphasized in the form of questions and answers and commentary dialogue. The second portion of the session will feature "hands-on" skill stations such as fiberoptic intubation procedures, protection of cervical spine injury and performing cricothyroidotomy.

Simultaneous Breakaway Sessions

Part I: Airway Management-- Case Discussions/Skill Stations

Friday June 12, 1992

11:00- 13:00 hours

Moderator-in-Chief: Dr. Elizabeth C. Behringer

Moderator:
Dr. Elizabeth A. M. Frost
Dr. Kenneth J. Abrams
Dr. Mark T. Murphy
Dr. Anne Sutcliffe
Charles Barton, C.R.N.A.

SESSION AGENDA

11:00-11:10

Introduction and Welcome

11:10-12:15

Case Discussions

- A. Techniques of Lung Isolation in the Management of the Traumatized Chest
Dr. Behringer
- B. Head Trauma
Dr. Frost
- C. The Laryngeal Mask airway in emergency airway management
Dr. Sutcliffe
- D. The Bullard Laryngoscope in trauma airway management
Dr. Abrams
- E. The Augustine Guide in trauma airway management
Mr. Barton
- F. Cervical Spine Injury
Dr. Murphy

12:15-12:30

Break

12:30-13:00

Airway Management Skill Stations

Drs. Behringer, Frost, Abrams, Murphy, Sutcliffe and Mr. Barton

- 1. Flexible Fiberoptic Laryngoscopy
Drs. Behringer, Frost and Murphy
- 2. The Augustine Guide
Mr. Barton
- 3. The Bullard Laryngoscope
Dr. Abrams
- 4. Laryngeal Mask Airway
Dr. Sutcliffe

TECHNIQUES OF LUNG ISOLATION IN THE MANAGEMENT OF THORACIC TRAUMA PATIENTS

Elizabeth C. Behringer, M.D.

A. Case History

A 20 year old previously healthy white male is admitted to the Emergency Room (ER) thirty minutes following a high speed skateboard accident. The patient lost control of his skateboard and collided with a large elm tree. At the scene, he was alert and responsive, complaining of shortness of breath and severe left chest pain. His left arm was grossly deformed. Initial vital signs: BP 100/60, P:110 reg, R: 30 labored. 100% facemask O₂ was administered by paramedics.

He arrives in the ER secured to a long spine board, hard cervical collar in place with two 14 gauge antecubital intravenous lines running Lactated Ringers solution. Vital signs on arrival in the ER: BP 70/palp, P:150 reg, RR:40 labored, O₂ saturation 92%. He is coughing up bright red blood. C X R reveals a large left hemopneumothorax. His entire left lung field is opacified. In addition, he has a comminuted left humeral fracture and multiple rib fractures. Lateral C spine film is clear through the seventh cervical vertebrae. The thoracic surgeons place a chest tube which drains 1500cc of bright red blood. The patient is scheduled for an emergency left exploratory thoracotomy.

B. Guidelines for Discussion:

1. Indications for One-lung ventilation
2. Isolation Techniques
 - a. Bronchial blockers
 - i. Univent tube
 - b. Single-lumen endobronchial tubes
 - c. Double-lumen endobronchial tubes.
3. Complications of lung isolation techniques.
4. Lung isolation techniques in patients with massive hemoptysis

C. References:

1. Wilson RS. Endobronchial Intubation in Thoracic Anesthesia. second edition Kaplan JA (ed) Churchill Livingstone, New York, 1991 pp. 371-388.
2. Gottlieb LS, Hillberg R. Endobronchial tamponade therapy for intractable hemoptysis. Chest. 1991;67:482.
3. Gourin A, Garzon AA. Control of hemorrhage in emergency pulmonary resection for massive hemoptysis. Chest. 1975;68:120.
4. Garzon AA, Cerruti MM, Golding ME. Exsanguinating hemoptysis. J Thorac Cardiovasc Surg. 1982;84:829.
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11. Slinger PD. Fiberoptic bronchoscopic positioning of double-lumen tubes. J Cardiothorac Anesth. 1989;3:486.
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HEAD TRAUMA

Elizabeth A. M. Frost, M.D.

A. Case History:

A 20-year old healthy, Caucasian male had been drinking with friends when a brawl broke out. He was struck on the head with a bottle and appeared to be momentarily dazed. However he continued fighting until police intervention terminated the disturbance. In the police van, his silence was initially attributed to alcohol overdose and to cocaine ingestion. On arrival at the police station he could not be roused. He was transferred immediately to the emergency room.

Physical examination showed a well-nourished, comatose patient; pulse 132bpm, and regular; blood pressure 180/100; respiratory rate 40/min. Chest sounds clear. Breath smelled of alcohol. A large stellate wound in the frontotemporal area was bleeding profusely. Right pupil was larger than left. He withdrew his arms to painful stimulation. Glasgow Coma Scale 6. Arterial blood gas on room air were PaO₂ 68mmHg; PaCO₂ 24mmHg; pH 7.5.

B. Guidelines for Discussion:

1. Establishment of the airway
2. Assessment and control of cardiovascular system
3. Anesthetic involvement in diagnosis
4. Anesthetic management
 - a. choice of agents
 - b. appropriate monitors
 - c. fluid therapy

C. References:

1. Tabaddor K, Frost EAM. The management of head injury, in E. Frost (ed): Clinical Anesthesia in Neurosurgery, 2nd edition, Butterworth - Heinemann, Boston, 1991, 403-38.
2. Miner ME, Allen SJ, Cardiovascular effects of severe head injury, in E. Frost (ed): Clinical Anesthesia in Neurosurgery, 2nd edition, Butterworth - Heinemann, Boston, 1991, 439-44.
3. Miller SM. Management of central nervous system injuries, in LM Capan, SM Miller, H. Turndorf (eds): Trauma Anesthesia and Intensive Care, J.B. Lippincott Co., Philadelphia, 1991, 321-56.
4. Frost EAM. Perioperative anesthetic management of central nervous system trauma, in JK Stene, CM Grande, (eds): Trauma Anesthesia, Williams & Wilkens, Baltimore, 1991, 250-65.

THE LARYNGEAL MASK AIRWAY IN THE EMERGENCY ROOM

Dr. Anne J. Sutcliffe BSc FFARCS ARPS

A. Case History:

A 34-year-old female pedestrian was hit by a car and sustained a severe head injury and facial lacerations, but no other injuries. On admission her Glasgow Coma Score was 7, she was unable to maintain her own airway and was bleeding profusely from the posterior nasal space. There was a need to protect her airway, but Endotracheal intubation was potentially difficult due to bleeding and the possible co-existence of a cervical spine injury.

B. Guidelines for Discussion:

1. Is the laryngeal mask airway (LMA) a suitable alternative to endotracheal intubation?
 - i. What is the LMA?
 - ii. What conditions are required for placement?
 - iii. Does the LMA guarantee a clear airway?
 - iv. Does the LMA protect against pulmonary inhalation?
 - v. What does placement of an LMA do to intracranial pressure?
2. How can the LMA be used as an adjunct to endotracheal intubation?
3. How can Foley urinary catheters be used to facilitate endotracheal intubation?

C. References:

1. Brain AIJ. The laryngeal mask - a new concept in airway management. Br J Anaesth. 1983; 55:801-805.
2. Brain AIJ et al. The laryngeal mask airway. Anaesthesia. 1985;40:356-361.
3. Broderick PM et al. The laryngeal mask airway. Anaesthesia. 1989;44:238-241.
4. Brain AIJ. Further developments of the laryngeal mask. Anaesthesia. 1989;44:530.
5. Calder I et al. The laryngeal mask airway. Anaesthesia. 1990;45:137-137.
6. Davies PRF et al. Laryngeal mask airway and tracheal tube insertion by unskilled personnel. Lancet. 1990;336:977-982.
7. Ito N et al. Laryngeal mask airway in acute cerebrovascular disease. Lancet. 1992;339:69.
8. Logan A StC. Use of the laryngeal mask in a patient with an unstable fracture of the cervical spine. Anaesthesia. 1991;46:987.
9. John RE et al. Airway protection by the laryngeal mask Anaesthesia. 1991; 46:366-367.
10. Griffin RM, Hatcher IS. Aspiration pneumonia and the laryngeal mask airway. Anaesthesia. 1990;45:1039-40.
11. Heath ML, Allagani J. Intubation through the laryngeal mask. Anaesthesia. 1991; 46:545-48.
12. McCirrick A, Pracilio JA. Awake intubation: a new technique. Anaesthesia. 1991; 46:661-63.

BULLARD LARYNGOSCOPY FOR TRAUMA AIRWAY MANAGEMENT

Kenneth J. Abrams, M.D.

A. Case History:

A 32-old-male was involved in a diving accident. On presentation to the resuscitation area, he was noted to be agitated and disoriented, Glasgow Coma Scale 9. There was notable maxillofacial injuries.

He arrived fully immobilized with a hard cervical collar in place. Initial vital signs were BP 90/50mmHg, pulse 54 BPM, respiratory rate 26 RPM.

Endotracheal intubation was accomplished with the Bullard laryngoscope.

B. Guidelines for Discussion

1. What is the Bullard laryngoscope?
2. Indications for use of the Bullard laryngoscope.
3. Endotracheal intubation technique with the Bullard laryngoscope.
4. Limitations and difficulty using the Bullard laryngoscope.

C. References:

1. Abrams KJ, Desai N, Katsnelson T. Bullard laryngoscopy for trauma airway management in suspected cervical spine injuries. *Anesth Analg.* 1992;74:619-23.
2. Shigematsu T, Mayazawa N, Yorozu T. Nasotracheal intubation using Bullard Laryngoscope. *Can J Anaesth.* 1991;38(6):798.
3. Saunders PR, Geisecke AH. Clinical Assessment of the adult Bullard laryngoscope. *Can J. Anaesth.* 1989;36(S):118-119.
4. Bjoraker DG. The Bullard intubating laryngoscopes. *Anesth Rev.* 1990;17:64-70.
5. Dyson A, Harris J, Bhatia K. Rapidity and accuracy of tracheal intubation in a mannequin: Comparison of the fiberoptic with the Bullard laryngoscope. *Br J Anaesth.* 1990;65:268-70.
6. Gorback MS. Management of the challenging airway with the Bullard laryngoscope. *J Clin Anesth.* 1991;3:473-77.

THE AUGUSTINE GUIDE FOR RAPID "BLIND" OROTRACHEAL INTUBATION OF THE TRAUMA PATIENT

Charles R. Barton, CRNA, M.ED

A. Case History:

A 27 year old male was involved in a motor vehicular accident. He was not wearing a seat belt and was thrown clear of the automobile. On presentation to the trauma admission area, he was awake and alert with a Glasgow Coma Scale of 15. He had an open fracture of his left tibia and fibula. He complained of neck pain and abdominal pain upon arrival.

The patient arrived on a long spine board with full immobilization including a hard cervical collar. Initial vital signs were BP 85/50 torr, pulse 110 BPM, respirations labored at 30 per minute. Diagnostic peritoneal lavage revealed grossly bloody fluid and abdominal laparotomy was ordered. Cervical radiographs revealed a fracture of C-5 with no displacement. No neural deficits were present.

The patient received fluid resuscitation with good response following infusion of crystalloids and 1000ml hetastarch. Mild sedation/analgesia was accomplished with midazolam and nalbuphine. The trachea was blindly intubated with use of the Augustine Guide while the patient's head was maintained in neutral alignment without rotation, extension or flexion of the neck. Following a normal neurological evaluation, anesthesia was induced with appropriate doses of thiopental, fentanyl, and vecuronium. Anesthesia was maintained with isoflurane, O₂, and air, and incremental doses of fentanyl and vecuronium as needed.

B. Guidelines for Discussion:

1. What is the Augustine Guide? What are the indications for its use?
2. Endotracheal intubation technique with the Augustine Guide.
3. Methods for dealing with possible limitations/difficulties using the Augustine Guide during initial learning curve.

C. References:

1. Augustine Guide Instruction Manual: Augustine Medical, Inc. 10393 West 70th Street, Eden Prairie, MN 55344 1991.
2. Grande CM, Barton CR, Stene JK. Appropriate techniques for airway management of emergency patients with suspected spinal cord injuries. *Anesth Analg*. 1988;67:714. * (This reference gives general principles for trauma airway management which are met when the Augustine Guide is utilized as recommended.)

CERVICAL SPINE TRAUMA

Mark T. Murphy, M.D.

A. Case History:

A 65 year old male is one week s/p Motor Vehicle Accident. The injuries he sustained included a subdural hematoma, an unstable fracture of the third and fourth cervical vertebrae, multiple rib fractures with significant pulmonary contusion and a fracture of the left radius.

The patient underwent evacuation of the subdural hematoma, splinting of the radial fracture and placement of a Halo device.

Currently, he is in the Neuro Intensive Care Unit (ICU) intubated with a presumed aspiration pneumonia, PaO₂ 80 on 50%FiO₂. The neurosurgical nurse calls to say the endotracheal tube cuff has torn.

B. Guidelines for Discussion:

1. Cervical Spine Injury
 - a. Incidence in the OR/ICU population
 - b. Effects on airway management
2. Strategies for endotracheal tube change
 - a. Change under direct vision
 - b. Change over a stylet
 - c. Flexible fiberoptic bronchoscope
3. Methods of oxygenation

C. References:

1. Crosby ET, Lui A. The adult cervical spine: implications for airway management. *Can J Anaesth.* 1990; 37:77-93.
2. Grande CM, Barton CR, Stene JK. Appropriate techniques for airway management of emergency patients suspected spinal cord injury. *Anesth Analg.* 1990;67:714-15.
3. O'Malley KF, Ross SE. The incidence of injury to the cervical spine in patients with craniocerebral injury. *J Trauma.* 1988;38:1476-8.

Trauma Anesthesia for Disasters

Moderator in Chief: Vladimir Kvetan, M.D.

Moderators : Peter J. F. Baskett, M.D.

Yoel Donchin, M.D.

T. Michael Moles, MBBS, FFARCS, DTMH

Michael J. Parr, MBBS, MRCP, FCAnaes

This session will begin with a short didactic presentation of basic principles of anesthesia under extreme conditions. Beginning with an explanation of the "rules of engagement," members of the audience will be assigned various roles that they will assume during the "simulations." The simulations will include combined mass casualty/disaster/military situations and will focus on evaluation of individual and team performance under stressful conditions. Participation will be limited.

Scientific Free Papers: Part 2

Moderator in Chief: Enrico M. Camporesi, M.D.

Moderators : Nicholas G. Bircher, M.D.

Marzio G. Mezzetti, M.D.

During this session participants will give a brief oral presentation using slides of scientific material related to trauma anesthesia and critical care.

SCIENTIFIC ABSTRACTS: PART II

Use of Self-Inflating Bulb in Detecting Esophageal Intubation

Clinical Assessment of the Augustine Guide® for Endotracheal Intubation

Influence of Early, Qualified On-Scene Resuscitation on In-Hospital "Do Not Resuscitate" Decisions in Patients with Severe Head Injuries

Recall of Surgery After Anesthesia for Trauma

Evaluation of the Augustine Esophageal Detector Device Stylet

Anaesthesia in Northern Iraq

Isolated Splenic Trauma Associated with Hemodynamic Stability: Role of Systematic Abdominal Computed Tomography (CT) in Surgical Decision Making

Risk of Bacteremia in Trauma Patients Due to the Usage of Intraoperative Autotransfusion

Correlating Jugular Bulb Oxygen Saturation and Cerebral Perfusion Pressure in Severe Head Injured Patients

Prospective Trial of Supranormal Hemodynamic Values as Therapeutic Goals in Patients with Multiple Trauma

Effects of Prostaglandin E₁ on Renal Blood Flow and Renal Function After Acute Ischemia in Dogs

Influence of Mast Inflation and Various degrees of Head Elevation on Intracranial Pressure in Children

Early Coagulation Disorders in Severe Head Trauma Patient in the Prehospital Settings

Early Experience of Integrated Pre- and In-Hospital Acute Management of Severely Injured Children

Interhospital Medical Transport of Patients with Severe ARDS

An Evaluation of Factors Interfering Upon Pulse Oximetric Monitoring in Prehospital Emergency Care

Blunt Splenic Trauma: Successful Nonoperative Management and Delayed Rupture, A Retrospective Analysis of Predictive Factors, Including Computerized Tomodensitometry (CT) Scoring Systems

Polytrauma in the Elderly

Low Respiratory Quotient(RQ) with Traumatized Patients

Emergency Airway Management in Trauma Patients with Cervical Spine Injury

Video Data Acquisition and Analysis System for Anesthesiology

Effects of Etomidate on the Cardiac Papillary Muscle of Normal and Cardiomyopathic Hamsters

Severe Perineal Injuries: Importance of Radiological Signs

Delayed or Missed Diagnosis in Multiply Injured Patients

USE OF SELF-INFLATING BULB IN DETECTING ESOPHAGEAL INTUBATION

MR. Salem, M.D., Anis Baraka, M.D., A.M. Brennan, M.D.,
H.J. Heyman, M.D., A. Podraza, M.D., U. Nimmagadda, M.D.

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American University Hospital, Beirut, Lebanon

Introduction: Recently the efficacy of the self-inflating bulb in differentiating esophageal from tracheal intubation has been established.¹ The principle underlying the use of the device is that the trachea is held open by rigid cartilaginous rings and hence air can be aspirated if the tube is correctly placed in the trachea. However, the esophagus readily collapses when a negative pressure is applied to its lumen. Thus, when the squeezed bulb (fitted to a standard 15 mm adaptor) is connected to a tube placed in the trachea, instantaneous and complete reinflation occurs. In contrast, if the squeezed bulb is attached to a tube placed in the esophagus, it will remain collapsed. In spite of the efficacy of the self-inflating bulb, false negatives (tube in trachea, but bulb remains collapsed) have been reported. It is also conceivable that false positives (tube in esophagus, but bulb reinflates) may occur following excessive bag-and-mask ventilation prior to intubation. The present investigation was carried out to test the efficacy of the bulb in detecting esophageal intubation in two situations: 1) following "esophageal ventilation" and 2) in the presence of a nasogastric tube.

Methods: Forty consenting adult patients undergoing elective procedures were studied. After induction of anesthesia, the trachea was intubated and the cuff inflated. The squeezed self-inflating bulb was attached to the tracheal tube connector and the speed of reinflation was noted. The bulb was then disconnected, and the tracheal tube was attached to the anesthesia circuit. The esophagus was then intubated under direct vision, using a tube identical to the tracheal tube but positioned to emerge from the opposite side of the mouth. The squeezed bulb was attached to the tube connector, and the speed of reinflation was noted. The anesthesia circuit was temporarily disconnected from the tracheal tube and connected to the tube in the esophagus to deliver three breaths at a tidal volume of 300 ml each using an Airshield ventimeter ventilator. The efficacy of the bulb in detecting esophageal intubation was again tested. In an additional 20 patients who had 18-French Salem Sump nasogastric tubes in place, the efficacy of the bulb in detecting esophageal intubation was tested.

Results: In all patients, the squeezed bulb instantaneously and completely reinflated when connected to tubes placed in the trachea, but remained collapsed when connected to tubes placed in the esophagus. Even after delivering three breaths to the tubes placed in the esophagus, the squeezed bulb remained collapsed. Tracheal intubation was confirmed by mass spectrometry, which showed the classic rectangular waveform but showed a flat tracing following esophageal intubation. The self-inflating bulb remained collapsed in patients who had nasogastric tubes in place.

Discussion: The present report shows that the self-inflating bulb can rapidly and reliably differentiate between tracheal and esophageal intubation. The bulb was effective in detecting esophageal intubation following "esophageal ventilation" and in the presence of a nasogastric tube. Although exhaled CO₂ monitoring has been considered the "gold standard" for confirming proper endotracheal tube placement, both false negatives as well as false positives have been described. The self-inflating bulb may also show false negatives, but in contrast to CO₂ monitoring, false positives are probably nonexistent.

Conclusions: The self-inflating bulb is a simple, inexpensive device that can reliably and quickly detect esophageal intubation. It can be used in areas outside the operating rooms such as hospital floors, emergency rooms, ambulances, and the trauma scene.

Reference: 1) Williams KN and Nunn JF. *Anaesthesia* 44:412-414, 1989.

CLINICAL ASSESSMENT OF THE AUGUSTINE GUIDE® FOR ENDOTRACHEAL INTUBATION.

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The Augustine Guide® (Augustine Medical Inc., Eden Prairie, MN) has recently become available for use as an aid to blind orotracheal intubation (see figure). The Augustine guide (AG) is designed as a foreshortened version of the MacIntosh blade with a blunt edge which is designed to be seated under the hyoid bone. A specially designed stylet is advanced through the AG channel and a preinserted endotracheal tube (ET) into the larynx. Entry of the stylet into the larynx is confirmed by free aspiration of air. The ET tube is then advanced over the stylet into the larynx. The AG and stylet are then withdrawn and successful ET intubation confirmed using conventional criteria. This study was undertaken to assess the success and failure rate of intubation with the AG in adults with easy or difficult airways.

After institutional approval and informed consent, 23 adults to date have participated in the study. Their ages and weights ranged between 18-80y (median=44y) and 51-144kg (median=74kg). Their ASA Class was: I=30%; II=43% and III=27%. According to the Mallampati classification¹, 22% were Class I, 43% Class II and 35% Class III. Attempts at intubation were done after general anesthetic induction and complete skeletal muscle relaxation with the head and neck in the neutral position and were performed by the same individual. They were described as easy if intubation was successful in the first attempt and difficult when > 1 attempt to position the AG was necessary.

ET intubation was successful 95.6% of the time and was easy in 69%; repositioning of the AG was necessary in 7 (30%). In 6/7 latter patients the stylet entered the esophagus which was detected 100% of the time and thus needed AG repositioning. Esophageal intubation did not occur in any individual suggesting that the stylet aspiration test was very sensitive and specific. In the single failed incident with the AG, intubation was easy under direct laryngoscopy with a Miller blade and the patient belonged to Samsoon and Young² Class II. We did not find any correlation between airway examination and ease or difficulty of intubation with the AG. There were no dental injuries and only minor trauma was noted in 6/23(26%).

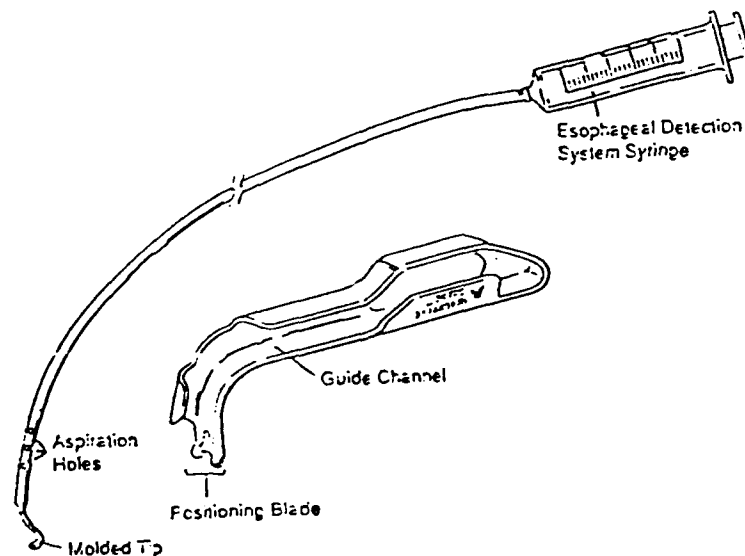
The AG is a safe and effective tool for blind orotracheal intubation in adults. Head and neck extension are not necessary. The stylet aspiration test prevents esophageal intubation.

References:

1. Mallampati SR, et al: Can J Anaesth 34: 204-13, 1987.
2. Samsoon GLT, Young JRB: Anaesthesia 42: 487-490, 1987.

Acknowledgement:

Thanks are due to Augustine Medical, Inc. for providing the Augustine Guides.



INFLUENCE OF EARLY, QUALIFIED ON-SCENE RESUSCITATION ON IN-HOSPITAL "DO NOT RESUSCITATE" DECISIONS IN PATIENTS WITH SEVERE HEAD INJURIES

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An effective on-scene resuscitation program results in more severely injured patients reaching the hospital alive. To evaluate the consequences of aggressive on-scene versus in-hospital resuscitation on subsequent "Do Not Resuscitate" (DNR) decisions, 561 consecutive severely head-injured patients were prospectively studied.

Patients resuscitated at the scene of the injury, in a regional hospital before transfer, or after direct admission to a level one trauma center were placed in groups 1, 2, and 3. A DNR decision was made when all possible therapeutic interventions proved ineffective and irreversible brain damage was diagnosed by the staff of the surgical intensive care unit (SICU), the neurosurgeon and a consulting neurologist.

In group 1 (n=94), group 2 (n=145) and group 3 (n=130) the DNR and mortality rates within the first 2 days (13%, 15%, 13%, respectively) as well as for the entire stay in the SICU (27%, 24%, 24%, respectively) were comparable, regardless of where resuscitation initially occurred. One hundred ninety-two patients did not meet criteria to be included in one of the three groups.

Our data do not support the assumption that aggressive resuscitation at the scene of the injury may, instead of improving overall outcome, increase morbidity and mortality rates because more severely head-injured patients now reach the hospital alive. Despite the fact that patients in group 1 presumably represent a category with more severe injuries, no difference in DNR or mortality rates between the 3 groups could be observed. We suggest that early, efficient resuscitation represents the best treatment for patients with severe head injuries as it will be a substantial contribution to the reduction of secondary brain damage.

Death and DNR rates according to circumstances of intubation

| Group and Mode of Transport | Total Number of Patients | Percent Intubated Within 1 Hour | Percent Intubated Within 1 Hour Dead + DNR | | Percent of All Patients Dead + DNR | |
|------------------------------------|--------------------------|---------------------------------|--|------------------------|------------------------------------|------------------------|
| | | | In 48 Hours | During Total SICU Stay | In 48 Hours | During Total SICU Stay |
| 1 (Intubated at Scene) | | | | | | |
| Helicopter | 72 | 93 | 8 | 22 | 8 | 22 |
| Ambulance | 22 | 96 | 27 | 41 | 27 | 41 |
| Total | 94 | 94 | 13 | 27 | 13 | 27 |
| 2 (Intubated at Regional Hospital) | | | | | | |
| Helicopter | 68 | 68 | 9 | 15 | 13 | 25 |
| Ambulance | 77 | 58 | 12 | 20 | 16 | 23 |
| Total | 145 | 63 | 10 | 17 | 15 | 24 |
| 3 (Intubated on Direct Admission) | | | | | | |
| Helicopter | 3 | | | | | |
| Ambulance | 127 | 58 | 10 | 19 | 13 | 24 |
| Total | 130 | 56 | 10 | 19 | 13 | 24 |

RECALL OF SURGERY AFTER ANESTHESIA FOR TRAUMA

M.V. Clemency¹, N.J. Thompson. Department of Anesthesiology, School of Medicine¹ and School of Public Health, Emory University, Atlanta, Georgia.

Purpose: Awareness during surgery and recall of intraoperative events are feared by patients. Trauma patients are thought to be predisposed to recall because of their limited toleration of anesthesia. It has been reported that 11 percent of trauma patients receiving anesthesia and 43 percent of those too unstable to receive a continuous anesthetic had recall of surgery.⁽¹⁾ None had received an amnestic agent. The incidence of recall at our institution did not appear to be as high as reported possibly reflecting our frequent use of amnestics as part of anesthesia for trauma surgery. This pilot study evaluated our current practice.

Methods: After institutional approval and patient consent, 101 patients undergoing surgery for abdominal, thoracic, neck and/or orthopedic injuries were studied prospectively. Anesthetic management was determined by the attending anesthesiologist. Information about the patient and anesthetic was gathered by the anesthetist on a data form and confirmed by an investigator. Each patient was interviewed at least once in the days following surgery. Data were compiled and analyzed using Chi Square and stratified Chi Square.

Results: The overall rate of recall (5%) was significantly less than that reported previously ($p=0.01$). When the data were stratified by "minutes without anesthesia" (Table), differences were most apparent in the group with "no anesthesia ≤ 15 minutes" ($p=0.036$) as opposed to the "no anesthesia > 15 minutes" ($p=0.66$). The incidence of recall was not influenced by the use of amnestics ($p=0.11$). Amazingly, no recall was reported by the 51 patients who did not receive an amnestic.

Table

Recall After Anesthesia for Trauma Study

| | <u>Total</u> | No Anesthesia <u>> 15 minutes</u> | No Anesthesia <u>≤ 15 minutes</u> |
|------------------|--------------|--|--|
| Patients studied | 101 | 9/101 (9%) | 92/101 (92%) |
| Recall | 5/101 (5%) | 3/9 (33%) | 2/92 (2%) |
| Amnestic given | 50/101 (50%) | 9/9 (100%) | 41/92 (45%) |
| Recall/Amnestic | 5/50 (10%) | 3/9 (33%) | 2/41 (5%) |

Recall = recall of intraoperative event

Amnestic = administration of scopolamine and/or benzodiazepine

Conclusions: This study shows that recall of trauma surgery after anesthesia is less than previously reported. Although amnestics did not appear to play a role, other factors, such as improved resuscitation protocols as specified by Advanced Trauma Life Support (ATLS), may permit the use of deeper levels of anesthesia and a lower incidence of recall. Further study of the effectiveness of amnestics in anesthesia for trauma is warranted.

References: (1) Bogetz MS, Katz JA. Anesthesiology. 1984;61:6-9.

TITLE: EVALUATION OF THE AUGUSTINE ESOPHAGEAL DETECTOR DEVICE STYLET

Author: A.L. Kovac, MD

Affiliation: Department of Anesthesiology, Kansas University Medical Center (KUMC),
3901 Rainbow Blvd., Kansas City, KS 66160-7415

The Augustine GuideTM (Augustine Medical, Eden Prairie, MN)(Figure) is a new device designed for rapid, blind, orotracheal intubation, which uses an esophageal detector device (EDD) as a stylet, over which an endotracheal tube is guided into the trachea. An esophageal obturator airway (EOA) also may be used in prehospital emergency care. Purposes of study: 1)to determine reliability of placement 2)to measure negative and residual pressure and volume, and syringe plunger recoil obtained when the EDD stylet was placed separately into the trachea and esophagus of a cadaver, with and without an EOA in place.

Three adult recently deceased pre-embalmed cadavers were obtained through the KUMC Anatomy Donor Program. Vacuum measurements were determined with an HP Amplifier 78205D and Timeter Calibration Analyzer RT-200. A Baxter Trantec pressure transducer was calibrated in pressure range 0-225 mmHg. Fifteen EDD stylets were evaluated three times each (n=45). Each EDD stylet was advanced to the same depth into the esophagus or trachea. A 35 ml syringe attached to stopcocks and EDD stylet measured mmHg vacuum and residual pressure, and ml residual and recoil volume. Residual volume was the volume in syringe after release of plunger. Residual pressure was pressure remaining in syringe after recoil of plunger upon release. This procedure was repeated with EOA in place and cuff inflated. Data values were evaluated by t-tests, ANOVA and chi-square tests. A p<0.05 value was set for statistical significance.

Esophageal placement of EDD stylet was the only group with high vacuum, high residual pressure, low residual volume and syringe plunger recoil (Table). Other groups had low vacuum, zero residual pressure, high residual volume and no syringe plunger recoil.

Positive tracheal confirmation of the EDD stylet syringe was easy aspiration of air with no resistance or recoil. Esophageal placement caused recoil and resistance to aspiration. There was no difference in negative vacuum recorded of EOA-trachea vs trachea with no EOA. True vacuum for esophagus with no EOA was much higher than EOA-esophagus, as exhibited by resistance to syringe plunger withdrawal and a residual pressure, recoil, and small residual volume (2-5 ml) after release of plunger. Actual vacuum for esophagus was greater than the highest measurable value of the vacuum monitor (overrange value=225 mmHg).

Definite recoil and resistance to aspiration, high residual pressure and low residual volume are present only with esophageal placement and no EOA. If an EOA is in place when testing with an EDD stylet, a false positive result may occur, allowing the intubator to believe falsely that the EDD stylet is in the trachea when, in fact, it is in the esophagus.

FIGURE: Components of
the Augustine GuideTM

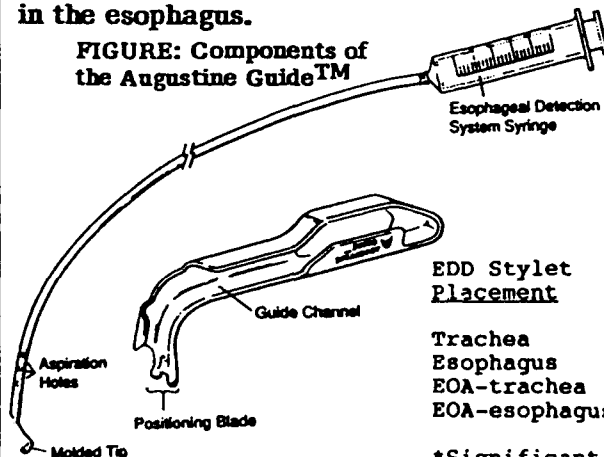


TABLE Values are mean \pm SD
(n=45)

| EDD Stylet Placement | Vacuum (mmHg) | Residual Pressure | Syringe Plunger | Recoil |
|-------------------------|--------------------|----------------------|-----------------------|--------|
| | | (mmHg) | Residual Vol. (ml) | |
| Trachea | 80.81 \pm 31.93* | 0* | 35 \pm 0.0* | No* |
| Esophagus | 224.4 \pm 1.55 | 51.25 \pm 22 | 2 \pm 1.0 | Yes |
| EOA-trachea | 90.64 \pm 21.98* | 0* | 35 \pm 0.0* | No* |
| EOA-esophagus | 173.35 \pm 50.31 | 0* | 35 \pm 0.0* | No* |

*Significant difference p<0.05 compared to esophagus

ANAESTHESIA IN NORTHERN IRAQ.

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Objective: To optimize future military anaesthetic practice.

Design: Prospective audit

Setting: A Royal Marine field hospital in Northern Iraq.

Results: 71 anaesthetics were administered to 62 patients over six weeks. The drawover Triservice anaesthetic apparatus¹ (TSA) was used with controlled hyperventilation and either halothane/trichloroethylene (HTCV) (23) or isoflurane (ICV) (16), for all emergency surgery and some elective procedures. Unsupplemented atmospheric air was used during stable anaesthesia, at an altitude of 1,200 metres, with satisfactory SpO₂. Other techniques for secondary surgery included spontaneous respiration from the TSA (HTSV) (9), ketamine/midazolam, either with controlled ventilation (KMCV)² (1), or without (KMSV) (12), or local anaesthesia (LA) (11). A degree of intensive care was provided for four patients. The Propaq 104 provided all necessary monitoring continuously.

Systolic blood pressure was significantly higher with ICV, compared with HTCV ($P < 0.05$). ICV patients recovered more quickly than with HTCV ($P < 0.05$, 17 versus 30 minutes for mean time from reversal to full orientation) but were significantly older and heavier ($P < 0.05$). ICV was administered later in the deployment when skill had probably improved. There were no differences in morphine consumption. Costs were 4.70, 8.84, 2.09, 0.66 and 8.57 pence/kg/hour for HTCV, ICV, HTSV, KMSV and KMCV techniques respectively and the entire anaesthetic drug cost was only £127. Drawover techniques with controlled ventilation were most satisfactory for children down to 6.5 kg.

Conclusions: Isoflurane is a highly acceptable alternative to the standard halothane/trichloroethylene combination with the TSA. Halothane cannot be used for the repeat anaesthesia so often necessary and trichloroethylene is now unavailable. Controlled hyperventilation with unsupplemented air is acceptable in stable patients and conserves valuable oxygen. Total intravenous anaesthesia was also a useful technique for secondary procedures. The TSA is suitable for paediatric patients with controlled respiration. Local anaesthesia is both feasible and useful in the field. Sophisticated monitoring is now possible in the front line and safe anaesthesia can be administered with minimal equipment.

References:

1. HOUGHTON IT. The Triservice anaesthetic apparatus. *Anaesthesia* 1981; 36: 1094-1108.
2. RESTALL J, TULLY AM, WARD PJ, KIDD AG. Total intravenous anaesthesia for military surgery. A technique using ketamine, midazolam and vecuronium. *Anaesthesia* 1988; 43: 46-49.

ISOLATED SPLENIC TRAUMA ASSOCIATED WITH HEMODYNAMIC STABILITY: ROLE OF SYSTEMATIC ABDOMINAL COMPUTED TOMOGRAPHY (CT) IN SURGICAL DECISION MAKING.

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* Department of Anesthesiology, Critical Care and Emergency.

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Treatment of isolated splenic trauma includes various attitudes from splenectomy to surgical abstention. However, surgical abstention requires precise diagnosis. The aim of this preliminary study was to evaluate the role of systematic CT in surgical decision making and medical supervision.

Methods: Patients were included in this prospective study when they had a history of isolated abdominal trauma with clinical signs of abdominal lesions and hemodynamic stability. All had splenic injury and/or hemoperitoneum diagnosed by abdominal echography, which is systematically performed in case of abdominal trauma in our Institution. Patients were excluded when aged over 60 years or when they required urgent surgery. Also were excluded patients with allergy to iodine, hemodynamic instability, other traumatic lesions requiring surgical procedure and/or a previous history of splenic disease or coagulopathy. When surgical abstention was *a priori* decided, patients were led strictly in the dorsal decubitus position for 3 weeks. During the first week, hemodynamic parameters were measured every hour, hematocrit every 6 hours, hemoglobin level and hemogram every day. During the next two weeks, clinical parameters and hematocrit were measured daily and hemogram 3 times a week. CT (Somaton Plus, Siemens, Germany) was performed immediately after trauma, 10 and 21 days afterwards. For these 3 examinations, the scans were realized before, within and after IV iodine injection.

Results: From January to December 1991, 16 patients entered the study. All of them exhibited peritoneal liquid at the echographic examination. Six patients had splenic fractures. Surgery was performed immediately after the first CT examination in 2 patients (splenectomy for multiple fractures and superior polar fracture) and after the second CT examination in 2 other patients (increasing volume of the hemoperitoneum: 1 splenectomy, 1 splenorrhaphy); the two remaining patients required surgical abstention. In these latest patients, hemoperitoneum disappeared at the second CT examination (hypodensity in 1 patient, hyperdensity in the other) and the last CT examination showed complete recovery. Ten patients had splenic contusion at the first CT examination. One patient required splenectomy after the second CT examination (sub-capsular hematoma and increasing volume of the hemoperitoneum). The other patients had spontaneously a complete recovery at the 3rd CT examination. No patients in the surgical abstention group required either transfusion or suffered for secondary splenic rupture.

Discussion/Conclusion: In victims of abdominal trauma with splenic lesion associated with hemodynamic stability, the repeated CT examination can help immediate and delayed surgical decision making. Indeed, contusions do never seem to require surgery, except sub-capsular hematoma. In contrast, splenic rupture necessitates a strict supervision.

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RISK OF BACTEREMIA IN TRAUMA PATIENTS DUE TO THE USAGE OF INTRAOPERATIVE AUTOTRANSFUSION

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During the last decade the use of intraoperative autotransfusion (IAT) has become a routine method for blood replacement during orthopedic and trauma surgery. However, it has been speculated (1) that bacteria derived from patients skin, wound and environment may gain access to the patients circulation.

The aim of our study was, to investigate whether there are differences in the frequency of bacteremia and infectious complications in patients treated with or without IAT.

Methods: We investigated in a randomized study design 36 consecutive patients suffering from hip fractures who underwent surgical repair. In group I (19 patients; mean age 66.5 ± 21 years) blood volume was restored by IAT (Shiley Therapeutic Autotransfusion System). Group II (17 patients; mean age 79.7 ± 13 years) received homologous packed red cells. Patients with carcinoma, evidence for infection or immunological diseases were excluded from the study. For determination of bacteremia blood cultures were taken from the reinfusion bag intraoperatively and by sterile venopuncture on the first postoperative day. Furthermore, leucocyte count, body temperature and C-reactive protein serum levels (CRP) were determined immediately preoperatively and daily during the first postoperative week. Data are expressed as mean \pm SD. For statistical analysis a chi-square test using Yates' correction was calculated. A p-value < 0.05 was regarded as significant.

Results: At the first postoperative day, we found positive blood cultures in 6 of 19 patients in the IAT group, while all blood cultures in group II remained sterile ($p < 0.05$). Isolated bacterial species were Staphylococcus epidermidis (4 isolations), Streptococcus viridans and Corynebacteria (1 isolation each). However, positive results in the cultured reinfusate were found in 13 out of 19 cultures (S. epidermidis: 10, S. viridans: 2, Corynebacteria: 1). Body temperature at the first postoperative day was higher in the patients with proven bacteremia (38.1 ± 0.5) compared to the patients with sterile cultures (37.6 ± 0.8), although this trend did not reach statistical significance. During the observation period no significant differences were found for leucocyte counts and CRP serum levels. No patient developed signs of clinically relevant infectious disease.

Conclusion: Bacterial contamination, which may lead to bacteremia, is a common finding in washed erythrocyte preparations for autotransfusion. However, all bacterial species isolated in our study exhibit a low pathogenic potency and therefore may lead to infection only in severely immunocompromised patients. Since none of our patients showed any clinical or laboratory signs of infection that persisted beyond the first postoperative day, a widespread usage of intraoperative autotransfusion does not seem to have a negative influence on patients course and outcome.

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CORRELATING JUGULAR BULB OXYGEN SATURATION AND CEREBRAL PERFUSION PRESSURE IN SEVERE HEAD INJURED PATIENTS.

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Recently, jugular bulb oxygen saturation (SjO₂) has been introduced in clinical ICU practice as possible bed side indicator of cerebral blood flow adequacy in severe head injured patients.

In the following report, we will discuss its possible value as bed side guide in defining the "optimal" cerebral perfusion pressure (CPP) by evaluating the correlation between SjO₂ and CPP.

Twenty patients, suffering from severe head injury (GCS<8) were selected. Intracranial pressure was monitored by means of an intraventricular catheter. Jugular bulb oxygen saturation was monitored by an Opticath 4F (Oximetrix) located in the jugular bulb. Jugular lactate determinations allowed the exclusion of already ischemic patients, for these have a proven poor correlation between cerebral blood flow and SjO₂.

Correlation between SjO₂ and CPP was analyzed during the first 3 days after trauma. Only values of non-ischemic periods (indicated by normal jugular lactate levels) were taken in consideration. Linear regression analysis of all data on CPP and SjO₂ showed a correlation coefficient of 0.19 (n=1440).

Individual analysis of patient data (n=72/pt) showed in 7 patients a correlation coefficient greater than 0.5 (0.55 - 0.81), while in 3 patients even a negative correlation could be established (-0.62 to -0.74).

The poor overall correlation could possibly be attributed to variations in other factors influencing the SjO₂ (as PaCO₂) or to CPP values far above the lower autoregulatory limit.

Evaluation of possible CPP breakpoints (= lower autoregulatory limit indicated by SjO₂ values less than 55 %) was then made.

In 7 patients, we observed a CPP breakpoint at 65 mmHg, starting from which CPP and SjO₂ decreased linearly. In the other patients no CPP breakpoint could be found (but the mean lowest CPP value in this group was 64.5 mmHg, while it was only 50.4 mmHg in the group with CPP breakpoint).

Nevertheless, it should also be noted that in patients with high CPP values (above 80 mmHg) low SjO₂ values (<55 %) did occur. Most of these could be attributed to low PaCO₂ values (hyperventilation !) or to severe anemia (haemoglobine less than 8 mg/dl).

In conclusion, we could state that continuous SjO₂ monitoring seems very promising in defining the individual "optimal" cerebral perfusion pressure in severe head injured patients.

**PROSPECTIVE TRIAL OF SUPRANORMAL HEMODYNAMIC VALUES
AS THERAPEUTIC GOALS IN PATIENTS WITH MULTIPLE TRAUMA**
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Multiple organ failure (MOF) following major trauma is a common problem associated with poor prognosis. Previous studies in septic patients have clearly demonstrated that the use of survivor's supranormal values as therapeutic goals reduces mortality, morbidity (number of failing organs) and length of respirator and ICU treatment. We hypothesized that these goals might also be useful in patients with multiple trauma.

Methods: In 1991 (prospective "supranormal" group), PA-catheters were placed in all patients with major trauma (ISS > 25); fluids (crystalloids, PRCs, FFP) and catecholamines (norepinephrine and dobutamine) were given to achieve the following goals: CI > 4.5 l/min/m², MAP > 70 mmHg, 12 < PCWP < 18 mmHg, O₂-extraction < 0.25, and lactate < 1 mmol/l. Evaluated here were only patients suffering from major trauma who survived at least 24 hours and had no head injuries (n = 18). The retrospective "control" group comprised of all 19 patients with similar trauma pattern treated in 1990. In these, fluid and catecholamine administration were guided by the following goals: MAP > 70 mmHg, 8 < CVP < 12 mmHg, diuresis > 50 ml/h. Duration of ICU and ventilator treatment, number of organ failures and outcome were compared between the groups.

Results: A summary is given in the table:

| Parameter | control group | supranormal group | significance |
|---------------|---------------|-------------------|--------------|
| Sex m/f | 13 / 6 | 15 / 3 | ----- |
| Age | 47 ± 20 | 43 ± 11 | n.s. |
| Age S | 36 ± 15 1 | 44 ± 12 1 | p < 0.05 |
| Age NS | 60 ± 20 1 | 36 ± 9 1 | p < 0.01 |
| ISS | 40 ± 9 | 43 ± 13 | n.s. |
| ISS S | 37 ± 8 1 | 39 ± 12 1 | n.s. |
| ISS NS | 44 ± 8 1 | 54 ± 13 1 | p < 0.05 |
| Resp. days | 22 ± 15 | 20 ± 9 | n.s. |
| Resp. days S | 26 ± 17 1 | 17 ± 10 1 | p < 0.05 |
| Resp. days NS | 17 ± 10 1 | 26 ± 15 1 | p < 0.05 |
| ICU days | 36 ± 37 | 28 ± 13 | n.s. |
| ICU days S | 49 ± 28 1 | 29 ± 13 | p < 0.05 |
| ICU days NS | 17 ± 10 1 | 26 ± 15 | p < 0.05 |
| ARDS 1st week | 6 | 4 | n.s. |
| ARDS late | - | 1 | n.s. |
| MOF 1st week | 7 | 2 | p = 0.08 |
| MOF late | 2 | 3 | n.s. |
| Deaths | 8/19 (42%) | 5/18 (28%) | n.s. |

Legend: S: survivors; N: nonsurvivors; 1 = p < 0.05 within group

Discussion: At present, the prospective group in this ongoing study is not large enough to allow for any recommendations. We believe, however, that slightly better outcome, decreased ICU and ventilator days, decreased number of MOFs and significantly higher ISS scores in nonsurvivors may prompt other investigators to test our hypothesis.

EFFECTS OF PROSTAGLANDIN E₁ ON RENAL BLOOD FLOW AND RENAL FUNCTION AFTER ACUTE ISCHEMIA IN DOGS

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Deterioration of renal circulation and renal function following renal ischemia are serious problems in clinical states. On the other hand, it has been thought that prostaglandin E₁ (PGE₁) play an important role for maintaining renal function. The present study was designed to investigate the effect of PGE₁ on renal blood flow (RBF) and renal function after acute ischemia.

METHODS: This experiment was approved and performed according to the Guidelines for Animal Experiment Society of Nagasaki University. The twenty-two mongrel dogs were anaesthetized with pentobarbital sodium and endotracheally intubated. The left femoral artery was catheterized for monitoring of arterial pressure and for the withdrawal of reference blood samples. The left femoral vein was catheterised for infusion of Ringer's solution. Cardiac output and RBF were measured with electromagnetic flowmetry. Renal cortical and medullary blood flow were measured by a hydrogen washout technique and a tissue blood flow meter. The right kidney was removed and the ischemic model was made by clamping of left renal artery for 1 hour. The dogs were assigned into 3 groups. Group1 (n=8) was the control that had no treatment after ischemia. Group2 (n=7) was administered PGE₁ 10ng/kg/min for 2 hours into renal artery after declamping it. Group3 (n=7) was injected PGE₁ 1200ng/kg as a bolus into renal artery after declamping it. Statistical analysis were made with Student's t-test and $P < 0.05$ was considered significant.

RESULTS: In control group, acute renal ischemia caused a decrease in RBF and in glomerular filtration rate (GFR). The decrease in RBF and GFR was prevented markedly in group3 but not in group2. In group2, urine volume and excreted fraction of sodium (FENa) increased significantly as compared with control or group3.

CONCLUSION: The results show that bolus injection of PGE₁ into renal artery exerts effect to improve the reduction of RBF and GFR after renal ischemia. This effect might be due to inhibition of the renal afferent arteriole constriction. The continuous infusion of PGE₁ into renal artery has effects to inhibit reabsorption of water and sodium in renal tubules.

INFLUENCE OF MAST INFLATION AND VARIOUS DEGREES OF HEAD ELEVATION ON INTRACRANIAL PRESSURE IN CHILDREN:

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Military antishock trousers (MAST) is widely used in trauma patients with cardiovascular instability (1). These patients have frequently associated severe head injuries with the risk of increased intracranial pressure (ICP). The MAST have been implicated in increased ICP (2). The aim of this study was to establish the influence of MAST inflation with various degrees of head elevation on ICP and cerebral perfusion pressure (CPP) in children.

This study included 16 children 7.8 ± 3.6 years old, weighing 24 ± 3.8 kg. These children had previous extradural ICP monitor insertion for suspected intracranial hypertension. Baseline ICP was considered as moderately increased except in 3 patients with intracranial mass. All the children were normovolemic at the time of the study that was performed just before ICP monitor removal under light sedation with 0.3 mg/kg of intra-venous midazolam. ICP, mean arterial pressure (MAP) and derived CPP were measured under 5 different circumstances: supine (T0), after MAST inflation in the supine position (T1), with head-trunk elevation of 10° (T2), 30° (T3) and in the sitting position (T4), after MAST deflation in the sitting position (T5). Inflation pressure were 45 mmHg on limb compartments and 35 mmHg on abdominal compartment. Statistical analysis used Student's T-test and Anova with significance considered at $p < 0.05$.

MAST inflation produced a 30% ICP rise in the supine position without variations of MAP or CPP. A head lift of 10° was sufficient to reduce the ICP to its control value (T0). Further elevation of the head, though decreasing ICP, did not improve CPP.

| | T0 | T1 | T2 | T3 | T4 | T5 |
|-----|--------------|----------------|--------------------|---------------|--------------|---------------|
| ICP | 10.5 ± 5 | $13.8 \pm 5^*$ | $10.5 \pm 4^\circ$ | 9.3 ± 5.1 | 8.6 ± 5 | 5.8 ± 5.2 |
| MAP | 87.8 ± 4 | 88 ± 5 | 83.6 ± 6 | 82.3 ± 3 | 82.1 ± 6 | 79.3 ± 7 |
| CPP | 77.3 ± 6 | 74.2 ± 9 | 73.1 ± 8 | 73 ± 6 | 73.6 ± 8 | 73.5 ± 8 |

* $p < 0.05$ Vs T0 ° $p < 0.01$ Vs T1

In conclusion MAST inflation induces a moderate rise in ICP without deleterious effects on CPP in normovolemic subjects with mild intracranial hypertension. Positioning of the head can eliminate this rise. The beneficial effects of MAST on MAP and CPP in the presence of severe hypovolemia may probably overtake the deleterious effects on ICP in the presence of severe head injury.

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EARLY COAGULATION DISORDERS IN SEVERE HEAD TRAUMA PATIENT IN THE PREHOSPITAL SETTINGS

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Coagulation disorders are frequent in head trauma patient. They are related to the severity of the injury, and probably caused by the release of the brain endothelial fibrinolytic factors (). The origin of this phenomenon is not well known. The aim of this study was to assess the severity of coagulation disorders in head trauma patients in the prehospital settings. During their management by a medical team of the SAMU, 36 patients were studied. They have received ATLS according to their physical status. Blood samples were drawn on scene (T1) and at the arrival at the hospital (T2), for the laboratory test : platelet count, fibrinogen, a PTT, Pt, fibrin split products and degradation products. Patients characteristics and treatment were precisely recorded. Patients who have received 15 ml/kg of volume loading before reaching the hospital were excluded.

Results : the first sample (T1) were drawn at 36 ± 5 minutes after the accident, and the second (T2) at the arrival at the hospital at 35 ± 25 min. The patients were divided in 3 groups according to their Glasgow Coma Score. In group 1 (GSC = 15, n = 15) no coagulation disorder were observed, and no patient died. In group 2, (GSC < 15 n = 4) a coagulation disorder appeared at T2 in one patient. No patient died in this group. In group 3 (GCS < 7) 11 patients with severe isolated head trauma were included. Early coagulation disorder were observed (fibrin degradation products) in 69% of the patient and prolonged TPA in 43%. At T2, the coagulation disorders worsen : all the patients had a DIC, and 43% of them died.

In conclusion, coagulation disorder are early and severe head trauma patients with low GCS.

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EARLY EXPERIENCE OF INTEGRATED PRE- AND IN-HOSPITAL ACUTE MANAGEMENT OF SEVERELY INJURED CHILDREN:

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Multiple trauma remains the leading cause of death in children over one year (1). Most of the early deaths caused by acute respiratory failure, secondary brain lesions and inadequately treated intra-abdominal bleeding could probably be prevented by acute emergency management (2). This study reports our early experience with integrated pre- and in-hospital initial management of severe paediatric multiple trauma.

In the prehospital settings, initial resuscitation and medical evaluation was provided by medical team of the SAMU including a trained anaesthesiologist or an emergency physicians. A direct telephone consultation between the medical controller of the dispatching centre and the physicians in charge of the in-hospital receiving team was mandatory. It allowed a precise initial assessment of the severity of injuries, cotation by paediatric trauma score (PTS), Glasgow coma score (GCS), and activation of the hospital receiving team. The designated receiving area was part of the recovery room of our institution, a teaching paediatric hospital including all surgical and PICU facilities. Trauma team in charge of initial management and continuing monitoring during explorations was staffed by fully trained paediatric anaesthesiologists and immediately available consulting senior surgeons of all the required specialities. Mechanism, extent and severity of injuries, pre-hospital and initial in-hospital managements, surgical procedures, duration of stay in the recovery room and early deaths were analyzed.

Thirty five children 6.8 ± 4.4 years old, weighting 27.1 ± 3.4 kg with blunt trauma were admitted during this study. The main causes of the trauma were, fall 28.5%, pedestrian or bicycle and motor vehicle accidents 35.2%. Mean PTS and GCS were 6.6 ± 3.4 and 11.5 ± 4.5 . The most frequently observed injuries were: head (64.5%), orthopedic (57%) and thoracic trauma (32%). All children had an IV line inserted in the prehospital settings and they received 35 ± 25.5 ml/kg of colloids before admission and 6 out of the 35 were in hypovolemic shock at their admission. Tracheal intubation was performed at the scene in 37% (100% with GCS ≤ 8 and 62.5% with PTS < 8), and 8.5 % of the remaining patients were intubated at their admission. Mean duration of the management by the trauma team from arrival up to the transfer to surgical wards (or PICU) after stabilization, diagnostic tests, and surgical procedure when needed was 8.37 ± 7.9 hours. Invasive monitoring including radial artery catheter) was used in 51% of the cases. Surgical treatment included minor procedures performed in the recovery room (ICP monitors or thoracostomy tube insertion and orthopedic traction) in 30% and emergent surgical procedures in 40% of the cases. No possibly preventable death was observed in this series. Overall mortality was 8.5% with 5.4% within the first 12 hours.

An efficient link between in and out hospital care simplify the patient management. Involvement of trauma anesthesiologist in the prehospital settings is one of the simplest evolution improve this link, this is mandatory to reduce the early mortality of young polytraumatized children (3).

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INTERHOSPITAL MEDICAL TRANSPORT OF PATIENTS WITH SEVERE ARDS A.Rozenberg M.D.,
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Adult respiratory distress syndrome (ARDS) needs specialized treatment, such as extra-corporeal CO₂ removal (ECCO₂R) or extra-corporeal membrane oxygenation (ECMO) which are only available in few intensive care units (ICU)(1). Consequently the patients need to be transported as safely as possible to these specialized units. We report our experience in these transports.

Methods : 30 consecutive patients with severe ARDS were prospectively studied. Conventional methods of ventilation with positive end expiratory pressure (PEEP) was unable to provide correct blood oxygenation and CO₂ elimination. The transport team included at least one physician specialized in anesthesiology or critical care. Ambulances, helicopters or planes were used for transports. All patients were ventilated during the transport with sophisticated intensive care ventilators (Servo 900C Siemens or Bird 8400ST). Patients age (mean±SD), PEEP, FiO₂, lowest arterial systolic blood pressure (mmHg), arterial blood gases (PaO₂ and PaCO₂ before and just after transport , duration of transport (mean±SD), transports hazards and outcome were recorded. Patients were shared in 3 groups according variations of PaO₂ during transport : group 1 PaO₂ increased, group 2 PaO₂ did not change, group 3 PaO₂ decreased.

Results : Patients were 15 male and 15 female. Age was 30±9.9 years (min:13, max:50). Mean duration of transport was 179±92 min (max:420, min:60). Mean PEEP level was 12 (max:18, min:5). Mean FiO₂ was 0.85 (max:1, min:0.5). The mean lowest arterial systolic blood pressure was 105 mmHg (min:70, max:150). No patient died during transport. Table 1 shows variations of PaO₂ in each group.

| | PO2 before mmHg | PO2 after mmHg |
|---------|--------------------|-------------------|
| G1 n=13 | 76.7±41.2 | 139±96.3 * |
| G2 n=11 | 68.3±18.7 | 67.7±18 ** |
| G3 n=6 | 73.6±8.2 | 55.8±4.6 *** |

* p<0.05 vs pO2 before G1 **NS vs pO2 before G2 ***p<0.003 vs pO2 before G3

Tab.1 Variations of PaO₂ before and after transport

PaO₂ decreased significantly during transport in group 3. At the contrary PaO₂ increased in 13 patients in group 1. The improvement of arterial PaO₂ in group 1 may be explained by a better ventilation pattern provided during transport. Conversely the deterioration observed in group 3 maybe a direct consequence of ARDS evolution. After transfert 19 patients had benefit of ECCO₂R (11 survived, 8 died). ECCO₂R was not done in 11 patients (6 survived, 5 died).

We conclude that safe transport of patients with ARDS is possible. The main task is to maintain continuity of care (sophisticated ventilation and hemodynamic monitoring) in order to avoid PaO₂ deterioration (2). Critical care during transport is then mandatory and may be provided in the best way by a specialized medical team.

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AN EVALUATION OF FACTORS INTERFERING UPON PULSE OXIMETRIC MONITORING IN PREHOSPITAL EMERGENCY CARE

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This study was conducted to specify and quantify the factors, which interfere upon pulse oximetric monitoring during pre-hospital emergency care.

In this prospective study involving 400 patients treated by the medical team of the emergency helicopter service at Ulm/Germany (rescue helicopter "Christoph 22"), we systematically collected and evaluated factors limiting and influencing upon pulse oximetric monitoring.

Continuous pulse oximetric monitoring (Nellcor N 10 pulse oximeter, equipped with a digital probe DS 10^A) was maintained during all missions, beginning with arrival of the rescue helicopter team at the scene and continued until the patient was turned over to the receiving facility. For documentation, the measurements [pulse rate $f(t)$ and oxygen saturation $SpO_2(t)$] were continuously recorded on the integrated thermoprinter.

To quantify the time lost due to interference, index "S" was established. This index is defined as the quotient of disturbed measurement time and total measurement time ($S = t_{Dist}/t_{Total}$). Within the study group, the index average was $S = 0,269$, that is 26,9 % of measurement time was subject to interference. Motion artifacts (68 %) was the major cause of interference. Motion artifacts (MA) are classified, as either "passive" MA (caused by external forces, i.e. helicopter vibrations) or "active" MA (patient unrest). Within our study group "passive" motion artifacts (42 %) predominated over "active" motion artifacts (26 %). As a source of malfunctioning, motion artifacts were followed by probe dislocation (15 %), low perfusion (14 %) and stray radiation (3 %). Regarding the time lost due to specific interfering factors, motion artifacts (61,8 %) and low perfusion (25,5 %) were dominant, followed by probe dislocation (10,3 %) and stray radiation (2,4 %).

Interference therefore, both in frequency and in time was primarily caused by motion artifacts (especially "passive" MA) and low perfusion. There are two methods, by which the interfering factors can be reduced/eliminated:

1. ECG-Synchronization of the pulse oximetric signal.
2. The use of adhesive probes.

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BLUNT SPLENIC TRAUMA : SUCCESSFUL NONOPERATIVE MANAGEMENT AND DELAYED RUPTURE. A RETROSPECTIVE ANALYSIS OF PREDICTIVE FACTORS, INCLUDING COMPUTERIZED TOMODENSITOMETRY (CT) SCORING SYSTEMS

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Nonoperative management (NOM) of Blunt Splenic Trauma (B.S.T.) in adults has remained controversial throughout its recent development over the past ten years (1) mainly due to the risk of delayed rupture even though the risk of post splenectomy complications is substantial. Many have tried to find objective criteria for secure N.O. management, including CT scoring systems with dissimilar results (1, 2, 3).

The aim of this study was to analyze clinical and paraclinical data in B.S.T. patients managed non-operatively in order to determine whether criteria for safe N.O. management or predictive factors of delayed rupture could be found.

156 patients admitted to our trauma unit from 1980 to 1991 were retrospectively studied. We focused on a sub-group of 47 patients initially non-operated in the first 24 hours, divided into 3 parts : group I (N=35) with initial N.O. management (1A (N=23) : successful, 1B (N=12) : delayed rupture) and group II (N=12) with initially non-diagnosed delayed rupture. Criteria for NOM were : hemodynamic stability, ht stability with minimum blood replacement, no peritoneal signs. The following data were reviewed at different times from pre-hospital care with a minimum 1 month follow-up : abdominal symptoms, hemodynamic status with filling-up and blood transfusion requirements, associated abdominal or extra-abdominal trauma, blood parameters (hematocrit), chest x-rays, sonograms. CT scans, were analyzed blindly with two scoring systems (2, 3). Statistic analyses were performed using Student-T-Test and non parametric test. The main results appear on Chart 1.

In group I, NOM was successful in 20 patients ; 3 patients required laparotomy and splenic preservation was possible ; 12 patients (36,3%) required delayed splenectomy (extremes : day 2 to day 27) because of delayed rupture or persistent bleeding. Only one patient died in group 1A from associated injuries.

No statistically significant difference was found between the sub groups for the different parameters studied, except for the CT scoring systems : the Resciniti mean score was significantly lower in group 1A (p = 0.007) compared to group 1B or II while no patients with delayed rupture had scores lower than 2.5. The same observations were made using the Buntain grading system, but 54% of the patients with delayed rupture had a low grade.

We conclude that in hemodynamically stable patients, clinical and usual paraclinical data cannot predict safe NOM or delayed rupture. Only CT scores, when low, may help choose candidates for safe NOM, with a best accuracy for score including hemoperitoneum quantification.

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| GROUP | N | Age mean (SD) | Length of stay mean (SD) | HIS mean (SD) | Abdo. symptoms absolution | Packed red cells (mean of units) ± SD | Oxibide (ml) mean ± SD | Admission Hematocrit mean ± SD | CT GRADE (1) | | CT SCORE (2) | | CT Hemo- peritoneum (3) | |
|-------|----|---------------------|--------------------------------|---------------------|------------------------------|---|---------------------------|--------------------------------------|--------------|-------|--------------|------|----------------------------|-----|
| | | | | | | | | | ≤ 0 | ≥ 01 | ≤ 2,5 | ≥ 3 | ≤ 1 | ≥ 2 |
| 1A | 23 | 30,21 (3-78) | 22,2 (7-43) | 30,23 (0-61) | 80% | 2,76 ± 4,05 | 840 ± 1200 | 36,4 ± 3,9 | 81% | 19% | 80% | 40% | 54% | 48% |
| B | 12 | 36,8 (22-71) NS | 29,4 (12-60) NS | 39,87 (10-62) NS | 88% | 4,87 ± 4,50 NS | 1491 ± 1781 | 30,5 ± 12,3 NS | 84,5% | 45,5% | 0 | 100% | 0% | 80% |
| II | 12 | 41,34 (14-74) NS | 34,5 (18-80) NS | 27,27 (10-49) NS | 80% | 7 ± 13,82 NS | 1630 ± 2200 | 35,3 ± 9,8 NS | 60% | 40% | 0 | 100% | 10% | 90% |

Chart 1 : (1) Buntain grade ; (2) Resciniti score ; (3) Hemoperitoneum (from Buntain)

POLYTRAUMA IN THE ELDERLY.

309 elderly patients (>59 years) sustaining severe injury (ISS > 15) presented in one year with a mean age of 73 years and a median ISS = 29. These are compared and contrasted with 677 seriously injured adult patients (16-59 years) presenting in the same period, median ISS = 41.

116 (37.5%) of the elderly died before reaching hospital, 142 (46%) in hospital and only 51 (16.5%) survived. Significantly different to the adult group.

Differences in the mechanism, type, pattern and place of injury are discussed for both groups. The mechanism of injury in the elderly differs with that reported by European and North American studies.

Elderly in-hospital deaths were significantly less injured compared to the adults as measured by MAIS ($P=0.01$) and median ISS ($P=0.00005$). However, the elderly displayed significantly less physiological derangement for blunt injury on admission causing failure to recognise serious injury.

Missed significant injury ($p=0.0000005$) and poor airway management ($p=0.03$) were significantly more common in the elderly.

Elderly hospital death rate = 74% ($p < 0.0000005$) and compares unfavourably with Level 1 centres.

TRISS methodology identified significantly more elderly deaths ($p < 0.005$) and expert peer review significantly more elderly preventable deaths.

CONCLUSION. Severe injury amongst elderly of the United

Kingdom has not been previously reported. Our ability to save the elderly is poor. Remedies are suggested and difficulties with scoring injury severity in the elderly discussed. Polytrauma in the elderly is uncommon but an increase is inevitable as the population ages.

LOW RESPIRATORY QUOTIENT(RQ) WITH TRAUMATIZED PATIENTS

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Introduction

The RQ is a helpful part of indirect calorimetry determination, since it establishes the caloric equivalent of oxygen.

The RQ normally represents a range of 0.71 for the oxidation of fatty acids up to 1.0 for the oxidation of carbohydrate.

We investigated 10 traumatized patients who showed low RQ (<0.7) during the measurement of gas exchange using an indirect calorimeter attached to a ventilator in Intensive Care Unit (ICU).

The purpose of this study, therefore was to determine if the RQ during the measurement of gas exchange with traumatized patients in ICU.

Methods

After Institutional Review Board approval, 10 traumatized patients were studied. All patients were severely injured due to Motor vehicle accident(MVA). Ventilation was mechanically controlled by SERV0 900 C (Siemens, Sweden) ventilator.

The metabolic computer (NEC, Japan) was used for metabolic variables (Vo_2 , Vco_2 , RQ) measurement continuously.

The patients with severe respiratory failure were excluded in the study.

Result

In the initial 2 hours average RQ was 0.62 ± 0.06 (Mean \pm SD).

In 8 patients a gradual increase in RQ values was observed which reached the value over 0.70 after 19.4 ± 14 (SD) hours from the initial measurements. The low RQ remained unchanged on the other 2 patients who died within 72 hours after the admission to ICU.

Discussion

Sustained low RQ might indicate a poor prognosis of the patients. Most patients showed the signs of circulatory shock judged by elevated blood lactate levels and they received continuous catecholamine infusion. Augmented catecholamine levels might play an important role in increased oxygen consumption and low RQ. Abnormal communications between the lung and pleural space also might be responsible for low RQ.

EMERGENCY AIRWAY MANAGEMENT IN TRAUMA PATIENTS WITH CERVICAL SPINE INJURY

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Considerable controversy still exists as to the best method of endotracheal intubation in the traumatized patient with cervical spine injury. Many patients with multiple injuries require immediate airway management that makes awake intubation techniques difficult or impractical, indeed the airway is often secured before the diagnosis of cervical injury is made.

The policy at MIEMSS with acute admissions requiring emergency intubation is orotracheal intubation following rapid sequence induction with succinylcholine, cricoid pressure and manual in line stabilization of the neck. We conducted a retrospective study into patients with blunt traumatic cervical spine fractures to determine the incidence of post intubation neurological deficit.

Over the period Aug. 88 to Jun. 91, 393 patients with cervical spine fractures or fracture dislocation were admitted to the admitting area of the Shock Trauma Centre. Of these 278 had no neurological deficit and 115 patients had some deficit. Two hundred and twenty-five of the injuries resulted from motor vehicle accidents, 11 from motorcycles, 20 pedestrian, 2 cyclists, 77 from falls, 7 from beatings, 26 from diving and 26 other. Two hundred and eighty-five were male and 108 were female. The average Glasgow Coma Score was 13.6(range 3-15), Trauma Score 20.1(range 5-14) and Injury Severity Score 13.2(range 4-75).

Within 30 minutes of admission 36 patients were intubated orally asleep. Between 30 minutes and 24 hours 37 patients were intubated orally asleep, 18 nasally awake, 11 fibreoptically awake, one orally awake and one nasally asleep. From the period following 24 hours, 124 further intubations were required for further procedures, of which 43 were fibreoptic, 46 asleep oral, 23 awake nasal, 7 asleep nasal and 5 awake oral. There were two emergency cricothyrotomies for failed intubation. Thirty-two patients were intubated prior to admission. There were no cases of worsening neurological deficit associated with intubation.

Studies in cadavers¹ and patients² showing instability during orotracheal intubation have tended to recommend nasotracheal intubation³. Our experience with oral intubation and in line stabilisation of the neck in both the emergency and some elective cases leads us to believe that this is the method of choice. As shown above, most of the acute intubations (< 30 minutes) and many of the non acute intubations at MIEMSS were intubated orally with in line stabilisation, where factors such as airway compromise, altered conscious level, full stomach and patient compliance make other forms of intubation difficult. Indeed rapid management of the airway may limit adverse movement of the neck seen in prolonged intubation attempts. It is our conclusion that oral intubation with in line manual stabilization is an acceptable technique in cervical spine injured patients.

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VIDEO DATA ACQUISITION AND ANALYSIS SYSTEM FOR ANESTHESIOLOGY

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Performance of anesthesiologists in the clinical environment has been judged on the basis of peer review, subjective observation, data from mortality and morbidity conferences, case reports and examination of closed claim insurance studies. There is very little behavioral data available on anesthesiologists' performance under stress, because critical incidents in anesthesia are rare, unpredictable, and inadequately documented. During trauma patient resuscitation and anesthesia there are a higher than usual number of critical events. In order to study anesthesiologists in this environment we configured a video data acquisition and analysis system.

Because the efficacy of treatment for trauma patients depends heavily on restoration of abnormal physiological parameters to optimal ranges, we interfaced outputs from physiological monitors to the video data acquisition system. A personal computer (Everex PC386/SX) acquired physiological data through serial ports (RS232) from an eight channel monitor (Mennen model 2200) and mass spectrometer (Med Spec II) connected to the patient. The PC also supported 1) a time-code generator (Adrienne Electronics) writing machine readable time code onto a video cassette recorder (VCR, JVC BRS605U), 2) a video overlay processor (AiTech International) which displayed digital physiological variables on the video image recorded from a ceiling-mounted video camera (Panasonic GPKR402) and microphone (Shure SM57-CN), 3) a serial port to sense the status of the VCR (e.g start, running, tape end), and 4) a network board for remote control and off-loading data.

Videoanalysis used a PC386 AT&T with a time code reader (Adrienne Electronics), VCR controller (Triangle Research Collaborative (TRC) and video overlay processor (US Video) in addition to a VCR (JVC-BT7700) and video monitor. Observational analysis of the videos was supported by OCS Tools Software (TRC) and allowed frame-accurate control of the VCR by time code. Anesthesiologists behaviors can be coded by single keys or by logging of time-stamped textual comments about the scene being viewed. The resulting observational data file was quantified by summary statistics and related to the corresponding physiological data using Paradox database software.

This system facilitates exploratory data analysis because of its flexibility, ease of use, and both interactive and analytic strengths. Other investigators have filmed physiological monitors with a second camera and viewed the scenario and monitors simultaneously but without interfacing. The configuration described has the advantage of requiring only one camera and allowing critical points in treatment to be rapidly located for detailed videoanalysis by automatically scanning the physiological database for time intervals when these parameters were abnormal.

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EFFECTS OF ETOMIDATE ON THE CARDIAC PAPILLARY MUSCLE OF NORMAL AND CARDIOMYOPATHIC HAMSTERS

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Etomidate is a short-acting intravenous anesthetic associated with no significant cardiovascular depression during induction of anesthesia. It has been shown that etomidate has no significant inotropic effect on isolated rat cardiac papillary muscle (1), but its effects on diseased myocardium remain debatable.

The effects of etomidate (1 and 5 $\mu\text{g}\cdot\text{ml}^{-1}$) on the intrinsic contractility of left ventricular papillary muscle from normal hamsters ($n = 10$) and those with cardiomyopathy ($n = 12$) (BIO 82.62, 6 month old) were investigated. Contractility of papillary muscles from hamsters with cardiomyopathy was less than that of controls, as shown by the decrease in maximum shortening velocity (-25 %, $p < 0,001$), isometric active force (-45 %, $p < 0,01$), peak power output (-58 %, $p < 0,01$), and sarcoplasmic reticulum function. Etomidate did not induce a significant inotropic effect as shown by the absence of changes in maximum shortening velocity and active isometric force, except at 5 $\mu\text{g}\cdot\text{ml}^{-1}$ in cardiomyopathic hamsters ($+8 \pm 10$ %, $p < 0,05$). The effects of etomidate on these inotropic parameters were not different in normal and cardiomyopathic hamsters. Etomidate impaired contraction-relaxation coupling under low load in both groups, suggesting that etomidate decreased the sarcoplasmic function. But, this impairment was less pronounced in cardiomyopathic muscles. The effects of etomidate on contraction-relaxation coupling under heavy load were not different between groups. In both groups, etomidate had no effect on the peak power output and the curvature of the total force-velocity curve, suggesting that it did not modify the muscle myothermal economy.

In conclusion, etomidate had only a slight effect on the intrinsic mechanical properties of hamster cardiac papillary muscles and these effects did not depend on the pathophysiological state of the myocardium. These results may be clinically useful as, unlike etomidate, most anesthetics actually depress myocardial contractility.

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SEVERE PERINEAL INJURIES : IMPORTANCE OF RADIOLOGICAL SIGNS

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Pelvic trauma is often associated with perineal lacerations and genito-urinary injuries. Anorectal injuries, however, may be present too and have to be recognized.

We describe 3 cases of pelvic trauma with severe blunt perineal injuries associated with ano-rectal wounds. These were confirmed by radiological (standard and CT-scan) examination, severe pelvic bone fractures being associated with the presence of gas within the deep perineal structures.

CASE AGE SEX HISTORY X-RAY DIAGNOSIS TREATMENT EVOLUTION

| | | | | | | | |
|---|----|---|---------------|---------------------|--------------------|--|----------------|
| 1 | 36 | M | pelvic trauma | standard | rectal wound | colostomy debridement | MOF demise |
| 2 | 34 | M | pelvic trauma | standard CT scan | anorectal wound | laparotomy colostomy debridement cystostomy | MOF demise |
| 3 | 20 | M | pelvic trauma | standard CT scan | anal wound | colostomy cystostomy | reco- vered |

Conclusion : In our experience, severe ano-rectal complications after pelvic trauma may be recognized on radiological examination, standard but mainly CT scan. The search for the presence of gaseous extraperitoneal collections is essential to diagnose such lesions.

DELAYED OR MISSED DIAGNOSIS IN MULTIPLY INJURED PATIENTS.

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STUDY AIM. To examine the full spectrum of injuries missed upon admission, reasons injuries are missed, with recommendations to minimise this problem.

A one year prospective study of 16 admitting hospitals identified 658 patients with an injury severity score (ISS) \geq 15 arriving alive.

171 (M=119:F=52) patients (26%) had a significant injury missed.

Mean age 51.8 years (range 0-92). Median ISS = 30.

115 (67.3%) patients died in hospital. Significantly increased incidence of missed injuries in fatalities, ($p=0.0000005$).

17 (9.9%) patients had 2 missed injuries, 4 (2.3%) had 3 missed injuries. Total of 196 injuries missed.

Distribution of missed injury: 44.9% head, 29.6% thorax, 15.2% abdomen.

Significance of missed injury;

36.8% of injuries were life threatening, 48.5% caused death, 14% were potential causes of significant morbidity and 0.6% minor morbidity.

60 (35.1%) patients had missed injuries diagnosed at post-mortem. 65% of these injuries caused death.

Significantly greater incidence of missed blunt injury by A&E staff, general surgeons, and neurosurgeons for survivors versus fatalities, and preventable versus non-preventable deaths.

Unexpected deaths from TRISS analysis had significantly

increased incidence of missed injury.

REASONS INJURIES MISSED.

Altered level of consciousness due to head injury/alcohol, poor clinical assessment by junior staff, inadequate x-ray facilities, admission to inappropriate setting, reluctance to investigate elderly, low incidence of polytrauma with multiple admitting units.

CONCLUSION. High incidence (26%) of missed injuries, 85.4%, of which threaten life.

RECOMMENDATIONS.

Senior personnel, ATLS treatment protocols, tertiary trauma survey, rationalisation of trauma facilities.

EXHIBITORS & SPONSORS 1992

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PHYSIOLOGIC AND PHARMACOKINETIC CORRELATIONS IN CRITICALLY ILL SEPTIC PATIENTS:
A PROSPECTIVE STUDY WITH AMIKACIN.

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We have prospectively evaluated the disposition kinetics of amikacin and the correlation between changes in physiological variables and variability in pharmacokinetic parameters in 20 critically ill septic patients.

Patients were monitored by means of a pulmonary floating catheter in order to determine pulmonary pressures and cardiac output by thermodilution. $\dot{V}O_2$ was calculated by means of Fick's inverse method and the hemodynamic variables using standard formulas. Amikacin was administered in a 30 minute infusion. Samples were collected 0.5, 1, 2, 4, 6 and 8 hours after infusion to determine amikacin concentration. Amikacin levels were determined by means of radio-immunoanalysis with a variation coefficient intra-assay and inter-assay of 3% and 4%, respectively, and a sensitivity of 1 mcg/ml. Pharmacokinetic parameters were determined by using a minimal squares non-linear regression analysis assuming a one-compartment model by means of the PCNONLIN program. The correlation between pharmacokinetic (dependent) and physiologic (independent) variables was carried out by means of a multiple stepwise lineal regression analysis.

A wide interindividual variability was demonstrated for distribution volume, elimination constant (k_{el}), clearance (Cl) and half-life ($t_{1/2}$). Variability in Vd was accounted for by means of albumin concentration, hemodynamic and metabolic status and patient's age. Hemodynamic and metabolic status, and severity of illness (APACHE score) were determinants of the variability in k_{el} . Clearance of amikacin strongly correlated with hemodynamic status, severity of illness and creatinine clearance (Clcr). Amikacin $t_{1/2}$ was more affected by changes in clearance than by increase in Vd. Cmax did not reach efficacy levels (20 mg/L) with the use of standard recommended doses in 90% of the patients.

Physiologic and metabolic response to stress have a significant influence on disposition kinetics of amikacin. When treating critically ill septic patients, an individualization of dosage is needed, taking into account the physiologic - pharmacologic interrelationship. Monitoring of amikacin plasma concentration and of significant physiologic variables must be an integral part in the rational antimicrobial management of these patients.

Pharmacokinetic Variables

| Vd(L/kg) | k_{el} (hr ⁻¹) | Cl (ml/min) | $t_{1/2}$ (hrs) | Cmax(mg/L) |
|-------------|------------------------------|-------------|-----------------|------------|
| 0.39 ± 0.22 | 0.168 ± 0.109 | 68 ± 47 | 5.0 ± 2.2 | 8.0 ± 4.2 |

Physiologic - Pharmacokinetic
Models

$$\begin{aligned} Vd(L/kg) &= 0.26 + 0.039(\text{albumin}) + 0.0039(C.I^*) - 0.0046(\text{age}) \\ k_{el}(hr^{-1}) &= 0.489 - 0.007(C.I) - 0.013(APACHE) - 0.0029(\text{age}) \\ Cl(ml/min) &= 22.1 + 8.3(C.I) - 3.2(APACHE) + 0.330(Clcr) \end{aligned}$$

*Cardiac Index .

CEREBRAL CIRCULATION MONITORING OF PATIENTS WITH SEVERE BRAIN DAMAGE IN INTENSIVE CARE.

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The aim of this study was to identify the emodinamical findings that indicate irreversibility of brain damage. To this end, 46 severely brain injured patients whose Glasgow Coma Scale scores were 7 or less had been monitored by Transcranial Doppler (TCD).

Velocity waveform (VW) analysis, Pulsatility and Resistance Indexes were mainly performed transtemporally or transorbitally for the middle Cerebral Artery (MCA) and Internal Carotid Artery (ICA). Additionally, Intracranial Pressure (ICP) and Cerebral Perfusion Pressure (CPP) measurements were recorded.

These findings were assessed both before and after loss of brain function had been determined by neurological and neurophysiological criteria.

We evaluated our data reliability in predicting outcome and diagnosing brain death and assessed the overall usefulness of Cerebral Circulation monitoring in the management of patients with severe brain damages.

RESUSCITATION IN NORTHERN IRAQ.

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Objective: To optimise future military resuscitative practice.

Design: Prospective audit.

Setting: A Royal Marine field hospital in Northern Iraq.

Method: The principles of Advanced Trauma Life Support¹ (ATLS) were taught to members of a Royal Naval surgical team during transit to Northern Iraq and subsequently applied to both civilian and military victims of explosive trauma over a six week period. Detailed records were made of each resuscitation, so that the experience could be analyzed and compared with previous policy during the Falklands war².

Results: 214 patients were admitted, 96 being surgical. Four Triage categories were used, T1, 2, 3 and 4, requiring immediate, early, late and minimal attention respectively. There were 6 T1 cases and 12 of 37 T2 casualties required active resuscitation. 10 of these 18 patients were under the age of 18 and 7 were admitted at once. 2 patients died. Cervical spine injury was difficult to exclude because of inadequate radiographs. Venous cut down was frequently unsuccessful, so that internal jugular vein cannulation was life saving. Crystalloid was used as the primary infusion without apparent disadvantage. Crossmatched blood was unavailable and one casualty died with haemolysis after massive transfusion. Hypothermia was a problem without blood warmers, despite the high environmental temperatures. Non medical staff were trained most effectively to assess vital signs, despite the late arrival of sophisticated monitors.

Conclusions: The principles of ATLS¹ appear to be applicable to the isolated military environment. No disadvantage or improvement in outcome was obvious when compared to the Falklands experience², but the numbers were small. Deficiencies in training and equipment have been clearly identified and subsequently resolved, so that outcome should improve in the future.

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THE TRAUMA ANESTHESIA IN HIROSHIMA UNIVERSITY HOSPITAL: A RETROSPECTIVE VIEW OF 90 CASES

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INTRODUCTION

Our hospital is a medical center to cover the tertiary grade care for emergency medicine in Hiroshima City which population is approximately one million. We reviewed our trauma anesthesia cases in order to elucidate their problems.

METHODS USED

All anesthesia records from January through December in 1991 were reviewed and trauma related cases were studied. Parameters analyzed were age, sex, names of disease and operation, type of anesthetics, ASA physical status, preoperative problems, date and time, the time between the injury and the induction of anesthesia, causes of trauma, durations of operation and anesthesia, blood and fluid balance, and preoperative laboratory findings.

RESULTS

Twenty-six hundred general anesthesia in total were performed in 1991. Ninety cases were trauma-related anesthesia.

Location of operative site; extremities alone were 57 cases (20 microsurgical reattachment surgeries included), multiple trauma were 12. [62 orthopedic, 13 abdominal, 6 thoracic, 5 neurosurgery, 5 ophthalmologic surgery]

Etiology; 30% traffic accidents, 12% industrial or agricultural device, 4% Typhoon, 43% others.

Major preoperative problems; hemorrhagic shock, a full stomach condition, anemia, and other coexisting diseases. Specific problems for microsurgical reattachment of finger and extremities were long anesthesia time (mean 350 minutes) at night, which lead man-power problems.

<Patient via ICU and Emergency Ward>

Eighty-seven emergency trauma cases were admitted to our ICU in the same period. They are mainly multiple trauma cases. In most cases they did not receive operation. When the victims were suspected as hemo/pneumo thorax, they received chest tubes immediately after admission and conservative treatment were applied for fractures. Emergency operations were performed on only 28 patients, who's vital signs were unstable or who has diagnosed/suspected active bleeding sites in the thoracic /abdominal cavities. Their major problem was hemorrhagic shock. We lost a traffic accident case due to uncontrolled abdominal bleeding.

CONCLUSION

Ninety trauma anesthesia cases were reviewed. The most grave patients were multiple trauma victims who had to receive thoracic or abdominal operation. Other social problem was a lack of man power for the microsurgical reattachment of extremities, which often needed overnight anesthesia.

ARE PATIENTS WELL MECHANICALLY VENTILATED DURING PREHOSPITAL CPR ?

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During Advanced Cardiac Life Support, intermittent positive pressure ventilation is commonly used with volume-preset ventilators independently of chest compressions. Maximum insufflation pressure is limited by the risk of barotrauma, by security systems and ventilator power itself. The aim of this study was to compare ventilation during CPR by spirometry, to initial settings.

METHODS : After institutional approval, 22 consecutive patients were resuscitated on the field after cardiac arrest. BLS was begun by firemen, and resuscitation was continued by a medical team including one of the authors : Patients in VF were at first defibrillated. All patients were intubated and mechanically ventilated (AXR1, MMS FRANCE). Initial ventilatory settings were as follow : tidal volume :10 ml/kg, frequency :20/min, I/E : 1/2, FIO₂ :1. Chest compressions were performed according to AHA protocols and guided by ETCO₂ monitoring. Spirometry was measured twice by a Wright Spirometer (Haloscale, FDE, UK) at 3 and 5 min. . When CPR was stopped (non resuscitated patients), a third measurement was finally done without any chest compression.

RESULTS : There was no difference regarding, age, previous history, and time onset of BLS and ACLS in resuscitated and non resuscitated patients. Results are summarized in table 1 :

| Minute Ventilation (MV) (L / min.) | During CPR | afterCPR |
|--|-----------------------------------|-------------------------------|
| Initial setting | 9-14 | 9-14 |
| Spirometry | 7-11 | 8-12 |
| Decrease in MV from initial value (mean \pm SD) | 27 \pm 11 % * | 9 \pm 3 % |
| (* p < 0.01 vs initial value) | | |

CONCLUSION : During CPR, spirometry in patients mechanically ventilated, shows a significantly decrease of measured values compared to initial Minute Ventilation settings. This difference can be detrimental. Further studies are needed to evaluate ventilatory support during CPR for adequate oxygenation and CO₂ removal without deleterious effect.

TACTILE OROTRACHEAL INTUBATION: MODERN TECHNIQUE FOR EMERGENCIES AND DIFFICULT PATIENTS

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Emergency laryngoscopic orotracheal intubation is often difficult and may be dangerous or even contraindicated in cervical spine fractures. Visibility may be impaired due to vomitus, blood, profuse secretions, and anatomic variations (bull neck, protruding upper incisors, etc.).

Tactile orotracheal intubation was used over one hundred years ago by O'Dwyer in New York and MacEwen in Scotland. Unfortunately, the procedure was completely discarded when direct laryngoscopy was developed.

However, we will show that with modern improvements in technique - specially designed stylets - the procedure can be learned fairly easily on mannequins, fresh cadavers when available, and anesthetised patients.

Technique: The operator stands just below the right shoulder of the patient facing him or her. A suitable mouth gag is used and the operator slides the left index and middle fingers over the tongue pressing the right corner of the lips as far back as possible. With repeated curling of the fingers pressing the tongue down and forwards, the epiglottis will finally be encountered. While the middle finger holds down the epiglottis, the special springy curved stylet which is carrying the endotracheal tube is inserted into the mouth and guided along the side of the middle finger and under the left index finger. Using both these fingers and the right hand, the stylet is guided over the epiglottis, its springy anterior curvature seeking the glottis.

The stylet is inserted as far as possible and then the endotracheal tube is slid over it and the stylet is withdrawn. This is similar to the technique used by the senior author (P.C.) in hundreds of flexible fiberoptic bronchoscopies under local anesthesia. The flexible scope acts as the stylet and after being inserted into the trachea, the endotracheal tube which is carried, is slid over it into the trachea.

We have developed this tactile technique using mannequins, patients under anesthesia, and in the use of flexible bronchoscopy under local anesthesia. The technique is illustrated with slides and/or audiovisual.

COMPUTER SUPPORTED PATIENT DATA MANAGEMENT IN CRITICAL CARE - CHANCE FOR SPEEDING UP ROUTINE WORK.

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Introduction. Drawing up therapeutic and nutritional regimen, metabolic balances, as well as documentation of laboratory findings takes a considerable portion of the total time required for daily routine work in critical care. In the presented study we evaluated, to what extent a computer program for the support of these tasks can reduce the mean time requirement of the ICU physician in clinical routine.

Method. A computer program was developed, which is characterized by the following functions: 1. Management of patient's master data; 2. comfortable setup of regimen including nutritional, ventilatory, and nursing care; 3. interactive calculation of individual requirements of water, electrolytes, and nitrogen- and energy-delivering substrates, using several algorithms; compilation of an infusion regimen, which exactly coincides with the calculated requirement; 5. calculation of balances for water, electrolytes, and nitrogen for any period of time; 6. input and graphic display of biochemical profiles. The list of all available therapeutic procedures and laboratory parameters can be edited according to the necessities of the ICU. The program writes a log-file, which documents the time requirement for any single step, when patient data are processed. The software is written using TurboPascal (Borland) and runs on any PC with a 286 processor and DOS 5.0.

Results. In a preliminary study for the investigation of the rationalization of patient-related deskwork we evaluated the required time in 25 patients, as recorded by the program. The data was compared to the manually determined

| | Conventional | Program |
|----------------------------|--------------|---------------|
| Input of master data | 12±2 (5-18) | 10±5 (3-22) |
| Editing regimen | 18±5 (9-28) | 3±1.5 (1.5-8) |
| Calculation of balances | 23±8 (7-48) | 7±2 (4-11) |
| Calculation of requirement | 13±7 (4-20) | 4±1.7 (2-8) |
| Setup of Infusions | 2±1.3 (1-7) | 5±3 (2-12) |
| Laboratory findings | 8±5 (2-14) | 7±4 (3-15) |

time for the conventional management of an other 25 patients. In the patients, managed by the program, the required time amounted to 36±21 minutes, which was markedly shorter as compared to the manually managed patients (72±35 minutes). The gain of time is explained mainly by a considerable acceleration of setup of the actual therapeutic regimen, of the daily metabolic balance, and of the determination of the nutritional requirement (see table; mean±sem, range; all times in minutes).

Discussion and Conclusion. After a training period of 2 - 3 days, a marked acceleration of deskwork routine was achieved. This speeding up especially concerns procedures, which are associated with a considerable expenditure of writing and calculating (e.g. setup of therapeutic regimen, metabolic balances). Speeding up was minor in all calculations concerning nutrition. In return, the software-assisted establishing of nutritional requirement and the calculated infusion regimen was much more precise, as compared to the conventional technique. We conclude, that the use of the program means an essential acceleration of routine work in critical care and, moreover, an optimization of metabolic balancing and nutritional therapy in the ICU.

OXYGEN DELIVERY BY A PERFLUOROCHEMICAL EMULSION FOLLOWING VOLUME RESUSCITATION OF HEMORRHAGE IN DOGS

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Initial resuscitation of severe hemorrhage usually consists of rapid infusion of crystalloid and/or colloid solution with the aim of restoring adequate circulatory volume and improvement in cardiac output. Restoration of oxygen transport capacity is accomplished after arrival at hospital. This delay may subject the patient to a period of tissue hypoxia, which may sometimes be detrimental to his eventual recovery. The present study investigated the effect of administration, immediately after volume resuscitation, of a small dose of a 90% w/v emulsion of perflubron, a perfluorochemical emulsion capable of carrying 24.7 mL O₂ per 100 mL of emulsion.

Mongrel dogs were anesthetized with isoflurane, intubated and ventilated to normocapnia with room air. Intraarterial and Swan Ganz catheters were inserted to allow for monitoring of pressures, cardiac output, and determination of oxygen contents of arterial and mixed venous blood. Splenic contraction was induced by a bolus of epinephrine and, after stabilization, baseline cardiovascular and oxygenation measurements were made. To lower the hematocrit (Hct), the animals were hemodiluted using Ringers lactate solution (RL) to replace blood loss in a 3:1 ratio. Initial hemodilution to an Hct of 25% was followed by further bleeding and replacement with 1.5 volumes of a mixture of plasma (collected from shed blood) and 5% human albumin. The dogs respired 100% O₂ during and following this second bleed, which lowered Hct to 10-12%.

Following hemorrhage and resuscitation, cardiorespiratory variables were measured and were repeated every 30 minutes after the animals were given an infusion of 3 mL/kg of RL (Control, n=4) or 90% perflubron (n=5). As expected, large increases in cardiac output were observed in both groups following hemodilution and decrease of blood viscosity. Mixed venous PO₂ was significantly increased to > 100 mm Hg in the perflubron group in comparison to controls which remained at approximately 50 mm Hg. Perflubron carried oxygen accounted for about 25-30% of total oxygen consumption and this resulted in a considerable sparing of oxygen extraction from hemoglobin. These results demonstrate that a small dose of an oxygen transporting perflubron emulsion can improve oxygenation status in the volume resuscitated post hemorrhagic subject. If mixed venous PO₂ is to be regarded as an indication of tissue PO₂, this treatment can clearly improve the oxygenation status of the tissues.

AUTOLOGUS BLOOD TRANSFUSION IN TRAUMA AND ELECTIVE SURGERY.

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We studied eighty (80) patients I-II ASA classification randomly divided in two groups. They were operated on trauma or elective surgery followed by massive bleeding. In group A' the patients were transfused with stored blood from the blood bank and in group B' with autologus blood from the autotransfusion device (cell saver). Preoperatively and postoperatively we evaluated haemoglobin (Hb), haematocrit (Ht), prothrombin time, bilirubin level and the number of platelets. Intraoperatively we calculated blood loss, volume of transfused blood, mean arterial pressure (MAP), heart rate (HR), Hb, Ht, the values of blood gases, potassium and sodium from the bags of the stored blood and from the bags of the saved red cells.

The statistical analysis of our results showed a significant increase in Hb, Ht, PaO_2 , PaCO_2 and SAT values in the group of the saved red cells ($P < 0.05$). In this group the values of pH, K^+ , Na^+ and SBE were approximately at normal levels but the statistical comparison of the two groups gave significantly higher results for group B' (the group of the saved red cells) of our study ($P < 0.001$).

This study indicates that autologus blood transfusion is a safe method which requires the co-operation, enthusiasm and expertise of the anaesthetic team. Emergency and elective operations can be done without transfusion related morbidity from either an immunological mediated reaction or a transmitted infection, nowadays in particular the Acquired Immune Defence Syndrome.

A TRIAL OF AORTIC OCCLUSION TECHNIQUE WITH A BALLOON CATHETER FOR HEMORRHAGIC SHOCK DUE TO TRAUMA

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Since 1984, we have carried out aortic occlusion with a balloon catheter for treatment of massive hemorrhage due to trauma on abdominal areas or lower extremities.

Aortic occlusion technique: The aortic occlusion technique was adopted for trauma patients in which systolic blood pressure was less than 80 mmHg in spite of resuscitative infusion and transfusion. Before or after induction of anesthesia, an 8 F Fogarty catheter was inserted from the left femoral artery and advanced into aorta until the attached balloon reached the descending or abdominal aorta. Aortic occlusion was carried out by inflating the balloon with saline.

Patients analysis: Fifteen trauma patients in hemorrhagic shock were investigated. Thirteen of them were male. The mean age was 35.5 yr., ranging 17 to 57 yr.. The main causes of trauma were traffic accidents. The major injuries were on spleen(5 cases), liver(5), mesenteric vessels(4), kidney(2), gluteal artery(1). The most of the patients were suffering from multiple trauma. Operations included splenectomy(5 cases), liver suture(2), resection of alimentary tract(3), nephrectomy(2), repair of large vessels(3).

Prognosis: Six patients survived(S group) and nine patients expired(D group). One patients of the S group died later of cerebral contusion. In the D group, seven were dead during surgery and two cases were passed away within the 3rd postoperative day. In the S group, the aortic occlusion increased systolic pressure to over 80 mmHg, while, in the D group, systolic pressure did not increase to 80 mmHg after occluding aorta.

Discussion: Merits of the aortic occlusion with a balloon catheter for uncontrollable bleeding are as follows: 1. Keeping adequate cerebral and coronary flow, 2. Prevention of circulatory collapse after laparotomy due to loss of tamponade effect. 3. Decreasing blood loss during surgery. As compared with the cross clamping through thoracotomy or laparotomy, this technique is simpler and less invasive. Blood flow shut down effect of the technique with a balloon catheter is considered to be almost the same as that of the cross clamping. In the present investigation, blood pressure was well maintained by aortic occlusion in all of the S group, whereas in the D group blood pressure did not return to a desirable level even after the aortic occlusion. The main cause of intractable bleeding was thought to be due to hidden injured sites of major physiological significance or surgically untreatable injuries.

Conclusion: It can be said that the aortic occlusion technique with a Fogarty catheter is a simple, relatively non-invasive, and useful method for treatment of hemorrhagic shock due to trauma.

SERIOUSLY ILL OR INJURED CHILDREN TRANSPORTED BY AN
ANAESTHESIOLOGIST-MANNED EMS SYSTEM IN NORWAY.

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Norwegian Air Ambulance (NAA) operates EMS helicopters at
six bases, all manned with an anaesthesiologist. A fully
medical equipped vehicle is used in the areas adjacent to the
base, even responding to more remote locations when flying is
impossible due to weather or technical reasons.

We have done a retrospective study of children, 0-10
years of age, NACA scale 5, 6 and 7, transported by NAA in
1990 and 1991, to visualize the possible benefits of
anesthesiologists participating in EMS systems.

Of a total of 7133 patients, 1105 (16%) were in this age
group, of which 286 within NACA-group 5,6 or 7. The ratio
helicopter : vehicle were 214 : 72 (75:25%).
110 (39%) were interhospital transfers, 173 (61%) primary
missions responding to sites of accident or severe illness.
Mean call-response time of the primary missions were 15,6
minutes, requested by physicians in 32%, ambulance-personell
and laypeople each in 23% of the missions.

The most frequent causes of request were neonatal
emergencies or complications (31%), infections (19%) [sepsis,
epiglottitis, meningitis], trauma (15%), SIDS (15%) and near-
drowning/drowning (5%).

A total of 155 (54%) of the patients were intubated. In
the group of primary missions, 76 (44%) of the patients were
intubated at the scene, 88% of those by NAA anesthesiolog-
ists. Induction of general anaesthesia was performed in 19
(11%) cases, all by NAA. In the group of interhospital
transfers 85 (77%) of the patients were intubated, 9% by NAA
prior to transport.

The results of the study indicates that the skills of
trained anaesthesiologists were useful in handling the
problems and procedures of this age- and severity-group of
patients.

Due to the larger number of intubations than induction of
anaesthesia, one might draw the conclusion that those children
affected were in such a critical condition that a short
response time was imperative.

OUTCOME FROM SEVERE HEAD TRAUMA IN THE ADULTS

¹
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We evaluated the importance of the initial Glasgow Coma Scale (GCS), the number of injuries to the brain on admission, aspiration and later pneumonia on the outcome of adult patients with severe head trauma. A retrospective review of medical records of 50 adult patients with severe head trauma at the ICU between January 21, 1988 to May 15, 1990 was carried out.

Initial management comprised immediate resuscitation, GCS assessments, CT and surgical interventions if necessary. Intensive care management was according to protocol for cerebral trauma used in our ICU.

Table 1: Computed tomographic findings for 50 patients with head trauma

| CT findings | No. of patients |
|-----------------------------|-----------------|
| Cerebral contusion | 33 |
| Fracture of skull | 31 |
| Diffuse swelling | 27 |
| Fracture of base of cranium | 22 |
| Subdural hematoma | 12 |
| Intraparenchymal hemorrhage | 9 |
| Epidural hematoma | 7 |
| Other | 1 |

Table 2: Outcome related to initial GCS.

| IGCS | Patients No. | GR | MD | SD | Dead |
|------|--------------|----|----|----|------|
| 3 | 18 | 1 | 2 | 7 | 8 |
| 4 | 5 | 0 | 2 | 1 | 2 |
| 5 | 9 | 3 | 2 | 2 | 2 |
| 6 | 8 | 3 | 2 | 3 | 0 |
| 7 | 3 | 1 | 1 | 0 | 1 |
| 8 | 1 | 0 | 0 | 0 | 1 |
| >8 | 6 | 3 | 1 | 0 | 2 |

GR=good recovery, MD=moderate disability,
SD=severe disability, IGCS=initial Glasgow coma scale.

Table 3: Number of injuries to the brain related to outcome.

| Number of injuries (CC, FB, FS, DS, etc.) | GR | MD | SD | Dead |
|--|----|----|----|------|
| one of them | 2 | 3 | 2 | 1 |
| two of them | 4 | 3 | 4 | 0 |
| three or more | 4 | 6 | 6 | 15 |

GR=good recovery, MD=moderate disability, SD=severe disability,
CC cerebral contusion, FB=fracture of base of skull, FS=fracture of skull, DS=diffuse swelling.

Table 4: Aspiration and later pneumonia related to outcome

| Patient No. | GR | MD | SD | Dead |
|-------------|----|----|----|------|
| 23 | 4 | 7 | 6 | 6 |

GR good recovery, MD=moderate disability, SD=severe disability. 17 patients had later pneumonia, 6 patients died.

Our results (overall survival was 68%) confirm the importance of early triage of patients with head injury using the GCS enabled us to differentiate between two subgroups of patients (GCS 8) related to their outcome. Finally it's important in an effort to reduce mortality and disability of severely brain injured patients, to identify potential risk factors (like aspiration and later pneumonia), evaluate their significance and accordingly adjust therapies aimed at improving patient outcome.

TUMOR NECROSIS FACTOR-DEPENDENT EFFECTS CONTRIBUTE TO VASCULAR ALTERATIONS DURING WOUND HEALING

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A characteristic feature of host response is its localization to particular sites of the vascular tree, especially after postoperative or posttraumatic wound healing. Vascular endothelium is a target of cytokines, such as tumor necrosis factor (TNF), which are central mediators of the host response. TNF is able to induce a generalized vascular collapse in animals at high concentrations, whereas, at lower concentrations, lesions may be localized to particular parts of the vasculature. Exposure of cultured endothelial cells to TNF activates specific cell-dependent mechanisms which - in vivo - contribute to the inflammatory response like leukocyte adhesion, procoagulant activity and increase of vascular permeability.

In the present studies it was found that induction of endothelial growth and/or motility which occurs in regeneration after damage to the endothelial monolayer or during wound healing constitutes a selective target for TNF: induction of procoagulant activity on growing cells is about twenty times more sensitive to TNF than on "quiescent" cells (half-maximal effect on growing cells at 100 pM, on quiescent cells at 2 nM). This was demonstrated by testing the induction of tissue factor activity on the cell surface, as well as by testing the suppression of thrombomodulin, an important anticoagulant protein, produced and expressed by endothelial cells. Similar results were found comparing the induction of endothelial permeability by TNF. In parallel, cross-linking studies showed two additional bands on autoradiograms from sodium dodecylsulfate polyacrylamid gelelectrophoresis (SDS-PAGE) of cell-bound 125-Iodid-TNF, indicating special high affinity TNF binding sites on growing endothelium. Finally, radioligand binding studies indicated a twenty times higher affinity of growing endothelium for TNF compared to quiescent endothelium. These in vitro data suggest a model by which an injury or postoperative focus, resulting in increased induction of endothelial growth and motility, renders these cells more sensitive to perturbation by TNF, as to be expected during concomitant infections.

To control this hypothesis, animal studies were performed using rats with artificial wounds after subcutaneous implantation of polyvinylalcohol sponges. Autoradiograms of animals injected with 125-Iodid-TNF demonstrated that the growing vessels in the wound area are a specific target for TNF with an increased affinity for this cytokine. Additional histologic and ultrastructural studies could show that typical TNF effects like intravascular fibrin deposition, increased permeability with perivascular adhesion and permeation of leukocytes was induced in the wound area by low concentrations of TNF when no effect was seen in normal tissue. About three to four weeks after implantation of the sponge, no more difference was detectable between wound area and normal tissue.

Taken together, these data suggest a model for targetting TNF action within the vasculature: regulation of high affinity endothelial cell binding sites can direct TNF to activated cells in particular sites of the vasculature. Supported by the in vivo wounding studies, in which enhanced binding and responsiveness of endothelial cells to TNF was associated with angiogenesis, this model provides insight into one important mechanism by which cytokine action can be localized during wound healing.

**EFFECT OF HYPERTONIC SALINE ON INTRACEREBURAL OXYGENATION DURING
HEMORRHAGIC SHOCK USING NEAR INFRARED SPECTROPHOTOMETER**

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[Methods] Six mongrel dogs were anesthetized with pentobarbital and ventilated with air. Two optical electrodes of near infrared spectrophotometer (Hamamatsu Photonics Co) were fixed by bandage on the scalp. The contents of HbO₂, HbR, Cytochrome aa₃O₂

are recorded time to time by this spectrophotometer. Blood was drawn through arterial catheter until mean arterial pressure reaches to 45 mmHg at 15 min. after hemorrhage and MAP was maintained further for 30 min. (Group A). In group B, blood was drawn until MAP reaches to 65 mmHg. 1.5 ml/kg of 20% saline solution was injected over 10 min. through venous catheter.

[Results] HbO₂, HbR, CytO₂ revealed -25.3, +31.7, -2.6 μ Mol at 45 min. after hemorrhage. They recovered -3, +4.3, -1 μ Mol respectively at 5 min. after HSS administration and maintained those levels at least until 20 min. Group B (MAP: 65 mmHg) HbO₂, HbR, CytO₂ revealed -23.5, +14.5, -7.2 μ Mol at 45 min. after hemorrhage. They recovered -6.5, +3.4, -4.1 μ Mol respectively at 5 min. after HSS administration and maintained those levels at least until 20 min.. [Conclusion] Administration of HSS was effective on recovery of HbO₂, HbR, Cytochrome O₂ in the brain tissues during hemorrhagic hypotension. Those effects is more effective in group B (MAP: 65 mmHg) than in group A (MAP: 45 mmHg) although blood gas analysis indicated severe metabolic acidosis (PH 6.86, BE -24.2).

EMERGENCY TRANSLARYNGEAL VENTILATION

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Every anesthesia providers is aware of the serious consequences of anoxia subsequent to acute airway obstruction, and is trained to manage such situations when they occur. Nonetheless, a patent airway is not always attainable. Percutaneous needle laryngostomy with translaryngeal ventilation in the desperate situations in which other efforts, including intubation have failed. A review of literature suggested that using a large bore (> 18 Ga) needle/catheter with a jet ventilator, or alternatively connecting it to an oxygen source of high pressure (40-50 psi; i.e. anesthesia machine, wall outlet etc.) via a low compliance tubing will effectively resuscitate an animal or patient. However, this may expose the patients to the risks of barotrauma which has inhibited its widespread adoption.

In order to assess this risk, we have conducted an in vitro study employing a simple lung simulator and an anesthesia machine. Variables included the make of anesthesia machine, size of needle/catheter, degree and duration of depression of the flush valve, as well as the size of pop-off valve opening.

Based on the data obtained from our study as well as others by an extensive literature review, we have proposed some guidelines for this techniques when a jet ventilator is not available.

Early Trauma Management at Wellington Hospital, New Zealand.

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Abstract

Wellington Hospital is the base hospital for the capital of New Zealand. The metropolitan catchment population is 360,000. There is presently no co-ordinated system for the response to trauma admissions in this institution. In December 1990, selection criteria were established to identify patients presenting to the Emergency Department at risk of high energy or penetrating injuries in order to audit the management of these cases. During the first 12 months there were 152 cases identified for clinical audit. Patient demography, mechanism and severity of injuries are described. There were frequent deficiencies in documentation of patient vital signs. Management and diagnostic errors were noted. The audit supports the need for an organised trauma response in this hospital.

TRAUMA ANESTHESIA IN THE NETHERLANDS.

PROPOSAL FOR THE WAY TO GO

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PRESENT SITUATION

At this moment trauma centres do not operate in The Netherlands. It is a tradition that the management of a trauma victim is executed predominantly by surgeons. In the last decades it has become evident that trauma centres are needed and a governmental decision is to be expected.

Trauma teams and crash teams are already founded to integrate the organisations outside and inside the hospitals. Few anesthesiologists participate. In most cases ambulance nurses are responsible for the out of hospital management of trauma victims. As a consequence of these situations the clinical basis for trauma anesthesiology is poor.

OPTIONS FOR THE FUTURE

Because the contribution of the anesthesiologist in the management of a trauma victim is essential (monitoring, stabilisation, resuscitation, pain control and peri-operative management), anesthesiologists in The Netherlands have to look for opportunities to be actively involved in the organisation of traumateams, crash teams and the future trauma centres. In a second stage when sufficient interest, clinical training to residents and practical experience has been built up, anesthesiologists have to make their tribute clear in non-trauma centre hospitals. Optimal relation and mutual professional understanding with surgeons must have priority in this stage.

Parallel with this development some anesthesiologists can become involved in the out of hospital aspects of trauma anesthesiology by means of advices and training to ambulance nurses.

CONCLUSION

Trauma anesthesiology can contribute a lot to the care of trauma victims. Although future developments are still speculative, the foundation of trauma centres is an essential katalysator in the proces towards a consistent basis for trauma anesthesiology in The Netherlands.

PRE-HOSPITAL MEDICAL CARE OF THE HEAD INJURY PATIENT

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In Italy, as in all industrialized countries, from the epidemiological point of view, head injuries represent the most common cause of death in the population under 40 years of age, and this involves a very high socio-economic cost since the most productive age-range is affected. Moreover, many of those injured are left with handicaps and disabilities which further aggravate the negative consequences on the human and economic level. It has now been widely demonstrated that the faster and more efficient the emergency care the greater its chances of success, since fast intervention is able to prevent the rapid appearance of respiratory and circulatory complications which are often fatal and equally often potentially avoidable while also being more dangerous than the primitive lesion itself. This has led to the need to establish emergency services increasingly skilled in providing the seriously injured with medicalized pre-hospital care. It is considered necessary that these services should minimize the interval before care starts, considered the greatest threat to survival, and should enhance the possibility of the recovery of vital functions during the so-called "golden period" immediately after injury when the patient is able to draw the greatest benefits from suitable therapy; a service of this kind is able significantly to improve the prognosis both in terms of survival and with regard to the type and level of neurological and psychological recovery which head injury patients are able to obtain.

These aims have been a concrete reality since 9th August 1986 for the S.U.E.M. (Medical Emergency Service) of Veneto Health District 1, and this justifies the efforts of the medical-reanimation team, whose activities, in the specific case of the pre-hospital care of head injury patients illustrated below, have provided very flattering results.

It is not easy to categorize head injuries because of the virtually enormous variety of lesions which may occur, involving an infinite range of conditions: the way in which the accident occurred, the point and violence of the blow, the complexity of the structures affected, the size of the lesions and the age and state of the victim are just some of the variables which come into play in configuring each individual case. Progress in the management of patients with serious head injuries depends to a large degree on the precise determination of the gravity and extent of the brain damage and the potential recovery. It is therefore essential to select a system for assessing the gravity of the injury even as early as the pre-hospital phase in order to perform an effective triage of the patient and achieve the points summed up in the famous "3 Rs" (the right patient, in the right hospital, in the right time). As emerge from the data supplied by the literature, we are convinced that a modern, effective series of assessment which can already be applied on the site of the accident and in any case without the possible aid of diagnostic equipment must use prognostic indicators based on the clinical observation of the casualty, which are can easily be quantified on a numerical scale and correlated as accurately as possible with the mortality rates, the survival time, the duration of treatment and the degree of residual disability, thus providing us with a "retrospective" control on the quality of the therapies implemented.

Even if it is difficult to take immediate decisions in a clinical context which often changes rapidly because it is affected by hypoxia, low blood pressure or high blood alcohol levels, and very often diagnosis and treatment may proceed in parallel and simultaneously, the operating procedures we have applied in helicopter-ambulance of 149 head injury patients from 1.6.88 to 31.12.91 have always given absolute priority to stabilization of respiration and the cardiocirculatory system, the prevention of further blood loss, the immobilization of any fractures to the spine or the limbs using modern technique equipment, and the sedation of pain. In order to obtain an early assessment of the degree of brain damage and formulate a reliable prognosis, we use the TRAUMA SCORE, which combines Glasgow Coma Scale with the assessment of breathing pattern, blood pressure and capillary filling, together with the CRAMS SCORE for the overall assessment of the patient.

For these head injury patients, we provide an analysis of the various types of accident, instrumental diagnosis and any surgery performed, the treatment method used during the pre-hospital phase, the average time interval before medicalization of the patient, clinical stabilization and subsequent transfer to the most suitable establishment for the specific treatment required, the sexes and ages of the patients treated, breakdown by month, day of the week and time-band and the outcome.

An assessment of the data deriving from our fairly limited experience, highlights the undeniable operating effectiveness of the anesthetist-reanimator who initially safeguards the vital functions, thus allowing other specialist doctors to come into action "in cascade". The optimization of reanimation therapy therefore considerably reduces the overall recovery and stabilization times, thus allowing early achievement of the clinical conditions which permit the performance of all the surgery required.

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BRITISH ARMY TRAUMA LIFE SUPPORT (BATLS) : ITS APPLICATION IN THE RESUSCITATION DEPARTMENT OF A FIELD HOSPITAL DURING THE GULF WAR.

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The Resuscitation Department of a Field Hospital must be able to deal with large numbers of seriously injured casualties who may arrive simultaneously or in quick succession. Each casualty must be assessed, resuscitated and stabilised for life-saving surgery as quickly as possible to avoid "bottle-necks" from developing in the system. Given appropriate infra-structure in terms of environment, equipment and re-supply then the rate limiting step for rapid casualty handling is determined by the clinical skill of available personnel. All personnel must rapidly identify and treat those conditions that pose the greatest threat to life recognising that some injuries kill more quickly than others. They must all be competent in the performance of those diagnostic and practical skills which are vital for resuscitation. Their performance should be consistent, reproducible and complete to ensure that no injuries are missed, even under conditions of stress.

In the military environment it is impossible to provide Trauma Teams staffed entirely with qualified medical practitioners. Where nurses and combat medical technicians along with one doctor constitute a single trauma team there must be considerable delegation of clinical responsibility to the non-medically qualified team members. We describe the training and performance of such personnel in the BATLS system (a modification of civilian Advanced Trauma Life Support) in the Resuscitation Department of 32 Field Hospital, one of the two forward British hospitals deployed in northern Saudi Arabia during Operation Desert Storm.

We conclude that it is possible to train nursing and para-medical staff to be effective active participants in military trauma teams using the BATLS system.

FOR A BETTER TRAUMA CARE CAMPAIGN (INDIA)

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Purpose of Study : Organisation and development of Trauma Care in a city in Southern India (Madras).

Method used : Experience of a Private Trauma Care with experience of over 10,000 cases in 12 years.

Results : Development in assessment, development in investigations, development in management and treatment.

Conclusion : Based on the local conditions, without much reliance on Western interpretation and methods, Trauma Care can be organised in developing countries with heartening results.

Trauma Care is advanced in many developed countries. However it has been at a slow pace in developing countries especially in India. There is an intention to better services but the following points are against such development at present: Economic constraints, huge population, lack of trained paramedics, lack of public understanding, lack of public co-operation and general apathy.

Amidst all these constraints how does one go about organising standard Trauma Service. This paper gives author's experience for over 12 years in overcoming some of these difficulties and organising trauma care that is feasible to an extent comparable to others.

The paper deals of his experience in organising the basic set up, training of personnel, organising sophisticated investigations, educating the public about the importance of Golden Hour, seeking minimal co-operation from the Government, postgraduate teaching and helping in disaster management.

BURNS: THE FIRST FEW HOURS

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The immediate care of any trauma victim is crucial to survival.(1) This is no different for the thermally injured, no matter what the aetiology of the injury. The treatment of the thermally injured differs, however, from that of major trauma victims in that they may be transported to a tertiary referral centre for definitive treatment during the resuscitation phase.(2)

This video presentation has been produced to inform the emergency room residents, anesthesiologists, and nursing staff of the problems that need to be addressed before transfer, and how to transport a patient to the burns unit with minimal morbidity. The different resuscitation techniques are explained, and guidelines are given, and finally an example of a successful transfer is shown.

The video has a running time of twelve minutes.

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THE ROLE OF ENDOTHELIUM-DERIVED RELAXING FACTOR IN THE ANALGESIC EFFECT OF LIDOCAINE

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Lidocaine, one of the most widely used anesthetic, produced more prompt more intense, longer lasting and more extensive anesthesia than do an equal concentrations of procaine and prilocaine. Lidocaine has also been shown to induce the release of PGI_2 from isolated heart, which may contribute to its antiarrhythmic action. Endothelial cells also produce a vascular smooth muscle relaxant, known as endothelium-derived relaxing factor (EDRF). Although the chemical nature of EDRF is still unknown, some studies indicate that one of the EDRF might be nitric oxide (NO). Recently it has been shown that NO has an analgesic effect and therefore it is one of the analgesic mediator of the organism. Therefore, it seems to us interesting to investigate whether lidocaine has an effect on the release of EDRF from vascular endothelium. The isolated rabbit aortic strips precontracted by phenylephrine.

Acetylcholine produced a concentration-dependent relaxation in endothelium intact aortic segments. The relaxing effect of acetylcholine was completely prevented after the removal of endothelium. Addition of lidocaine to the medium, significantly enhanced the relaxing activity of acetylcholine. Neither procaine nor prilocaine did not change the responses. Asetylsalicylic acid failed to inhibit the potentiating effect of lidocaine.

From these result it was concluded that the potentiation by lidocaine of the vascular relaxing effect of acetylcholine is probably mediated through the increased release of EDRF from vascular endothelium. Since one of the EDRF is NO and NO has an analgesic effect, therefore it can be assumed that the long-lasting and more extensive analgesia obtained by lidocaine when compared with procaine and prilocaine might be due to its releasing effect of EDRF.

THE IMPACT OF HELI-RESCUE ON THE POLYTRAUMA MANAGEMENT IN ROMAGNA (ITALY)

M. Grilli; A. Gamberini; S. Preziosi; M.L. Ravaioli

Servizio di Anestesia e Rianimazione U.S.L. 35 - ROMAGNA ELISOCORSO - RAVENNA (ITALIA).

The ROMAGNA HELI-RESCUE SERVICE was set up in July 1987, as "second base" of the EMILIA-ROMAGNA REGIONAL HELI-RESCUE SYSTEM;

Between July 1987 and December 1991, 495 (15%) of the 3299 missions involved polytraumatized patients, 37% of whom were considered "severe" (Trauma Score < 12). In accordance with literature, 70% were males and mostly between 21 and 30 years old.

The cranial region was involved 69% of the time and the most frequent combination was: head trauma - limb fractures (17% of the cases).

Without a quantitative assessment of heli-rescue impact on patients outcome is not yet possible, several observations on the extra-hospital level of efficiency can be made:

- the average time-of-arrival at the accident site (within an area of 524 Km²) has been lowered to 7 min'.

- There has been a significant reduction in transport time to individual facilities.

- Cranial trauma deaths during transport from site to emergency ward has been lowered from 82% to 30%.

However, the progressive development of Heli-Rescue Service has rendered more evident the limits of hospital facilities and organization after polytrauma patient's arrival.

The authors stress the importance of stepping up the diagnostic-therapeutical course of polytraumatized patients within the hospital structure.

Since red-tape doesn't prevent the setting up of "TRAUMA CENTERS" in our Region within a reasonable time-lapse, the authors advise:

- the creation of specific and separate transit route to those regional hospitals apt to manage the more compromised traumas, where there is a team of polyspecialized personnel under the supervision of an emergency ward physician.

- the introduction of check list and protocols in the work-up and management and set priorities (field assistance, transport assistance, hospital assistance).

In conclusion the efficiency of an Emergency Medical field and hospital teams to guarantee fluidity of management.

If these do not occur, the heli-rescue will not improve much polytrauma patient's outcome.

DIAGNOSIS OF TRAUMATIC THORACIC AORTIC RUPTURE BY TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY (TEE).

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TEE is now considered to be more sensitive than angiography and CT scan for the diagnosis of spontaneous aortic dissection. However, the accuracy of TEE for diagnosis of traumatic aortic rupture remains unknown. During a 1-year period, all patients with severe thoracic trauma were prospectively examined, using TEE.

Among 25 patients with high-speed deceleration trauma or blunt chest trauma, and suspicion of aortic lesion on the chest X-rays (enlarged mediastinum, tracheal shift to the right downwards, displacement of the left main bronchus), 5 patients had traumatic aortic rupture, in which 4 types of lesions were noted during TEE.

In two cases, TEE visualized a partial rupture of the intima freely floating in the lumen of the descending thoracic aorta. The aorta was not divided in two lumens by a mobile intimal flap as in aortic dissection and the aorta was of normal size. In another case, an aortic dissection localized to the isthmus was observed ; the flap was not mobile and the false lumen was non circulating. In another case, TEE showed a typical aortic isthmus rupture with a false-aneurysm, communicating with the aortic true lumen. Color-Doppler visualized the entry tear of the false aneurysm. Above this lesion, a typical dissection progressed along the descending thoracic aorta. A mobile intimal flap divided the aorta into a true and a false lumen, both circulating. In the remaining case, a parietal hematoma of the horizontal part of the thoracic aorta was suspected. In all these 5 cases, the echographic findings were confirmed by angiography and surgery.

In conclusion, TEE is a useful, non-invasive diagnostic method which can be rapidly performed at the bedside, in the emergency room. TEE can diagnose aortic rupture and can also recognize different types of traumatic lesion. Thus, a prospective study is required in a large population of trauma patients, to compare the accuracy of TEE versus angiography for the diagnosis of traumatic aortic rupture.

COMPARISON OF THE HEMODYNAMIC EFFECTS OF HYDROXOCOBALAMIN AND COBALT EDETATE AT EQUIPOTENT CYANIDE ANTIDOTAL DOSES IN CONSCIOUS DOGS.

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It has been shown that smoke inhalation may induce severe cyanide poisoning (1). Among cyanide antidotes, nitrites decrease oxygen transport (2) and the antidotal action of sodium thiosulfate develops too slowly (3). Hydroxocobalamin and cobalt edetate are rapid and powerful cyanide antidotes which do not decrease oxygen transport. After smoke inhalation, cyanide poisoning is only be suspected but not confirmed inasmuch as cyanide blood levels are not known. Thus, it is important to know the effects of cyanide antidotes in non-poisoned animals or humans. We therefore compared the hemodynamic effects of cobalt edetate and hydroxocobalamin in conscious chronically instrumented dogs.

Hydroxocobalamin (70 mg.kg⁻¹) and cobalt edetate (10.5 mg.kg⁻¹) were compared at equipotent cyanide antidotal doses, in 14 chronically instrumented conscious dogs (descending aorta, pulmonary artery, and left atria catheters, miniature high fidelity pressure transducer in the left ventricle, electromagnetic flow probe around the ascending aorta). At the end of intravenous infusion (15 min), peak plasma cobalt concentrations did not differ in the two groups (412 ± 183 vs 400 ± 160 μmol.l⁻¹). Hydroxocobalamin induced a slight increase in mean arterial pressure (+17 ± 9 %, p < 0.05) and systemic resistance (+19 ± 15 %, p < 0.05). In contrast, cobalt edetate induced an increase in heart rate (+78 ± 33 %, p < 0.05), in cardiac output (+63 ± 39 %, p < 0.05), and in maximum increase in left ventricular pressure (+33 ± 15 %, p < 0.05), did not modify mean arterial pressure, and decreased systemic resistance (-36 ± 15 %, p < 0.05). These hemodynamic effects were associated with an increase in plasma catecholamine concentrations (epinephrine : 2,524 ± 3,025 vs 58 ± 37 pg.ml⁻¹, p < 0.05 ; norepinephrine : 1,106 ± 609 vs 343 ± 146 pg.ml⁻¹, p < 0.05), which in contrast remained unchanged after hydroxocobalamin administration. Cobalt edetate also induced an increase in blood glucose concentrations (9.9 ± 1.9 vs 6.1 ± 1.2 mmol.l⁻¹, p < 0.05) and a moderate metabolic acidosis, whereas hydroxocobalamin did not.

In conclusion, considering its lack of hemodynamically relevant effects, and its absence of modification of blood glucose concentrations, these results indicate that hydroxocobalamin is potentially a safer cyanide antidote than cobalt edetate.

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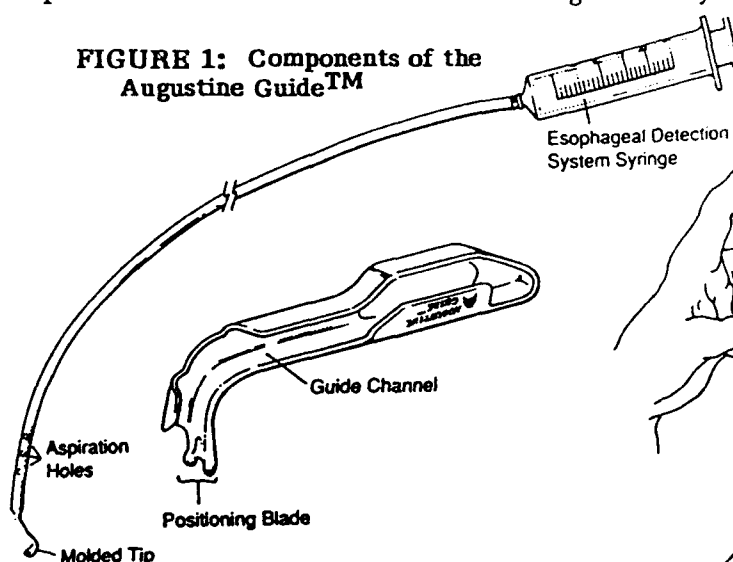
**TITLE: NASAL USE OF THE AUGUSTINE STYLET IN A PATIENT WITH KNOWN
DIFFICULT AIRWAY SECONDARY TO TREACHER-COLLINS SYNDROME**

Author: A. Kovac, MD

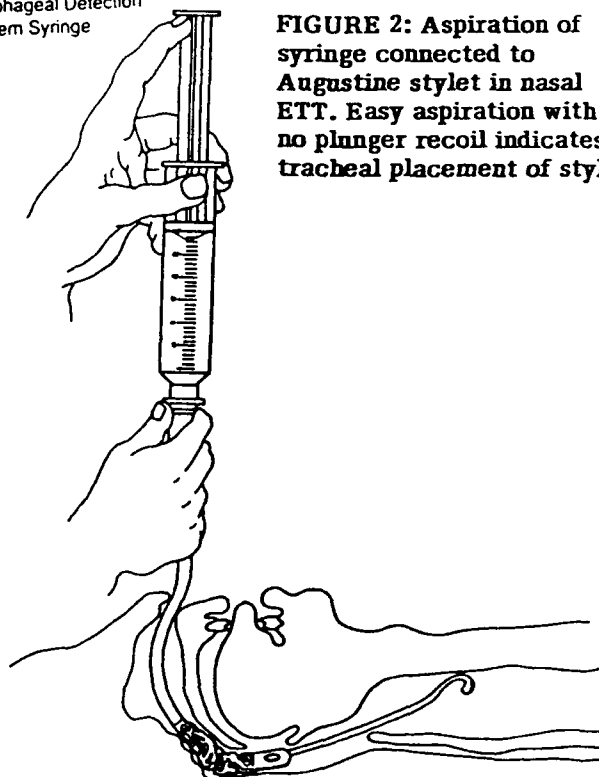
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Case Report A 36-year-old white male, ASA class II/V, with Treacher-Collins syndrome presented for a sixth operation to repair multiple facial anomalies. The patient was a known airway management problem, having been intubated with difficulty five times previously: twice fiber-optically and three times by transtracheal retrograde intubation. An awake intubation with the Augustine Intubation Guide™ was planned (Fig.1). The patient was pre-medicated with midazolam 4 mg IV and fentanyl 200 µg IV. Cetacaine spray and 4% cocaine spray were used to anesthetize the oro- and naso-pharynges, respectively. Bilateral superior laryngeal nerve blocks and transtracheal spray were performed with 2% lidocaine. The Augustine Intubation Guide™ could not be placed orally, secondary to the patient's short mandible, large tongue, protruding incisors and limited range of motion of the mandible. A 7.0mm endotracheal tube (ETT) was inserted nasally, but blind nasal intubation was unsuccessful. The Augustine stylet was then inserted through the nasal ETT and advanced, probing for the tracheal opening (Fig.2). With cricoid pressure and head extension, the stylet could be advanced. Aspiration on the 35cc syringe attached to the stylet was easy and confirmed placement in the trachea. The ETT was advanced over the stylet through the vocal cords and into the trachea. ETT placement was confirmed by chest auscultation and capnography. Anesthesia was then induced with 250 mg of thiopental IV and the patient was ventilated with 100% O₂ and 1% forane. The case then proceeded without complications, and the patient was extubated without difficulty. This is the first reported use of this method with the Augustine stylet.

**FIGURE 1: Components of the
Augustine Guide™**



**FIGURE 2: Aspiration of
syringe connected to
Augustine stylet in nasal
ETT. Easy aspiration with
no plunger recoil indicates
tracheal placement of stylet.**



REGIONAL AUDIT OF RESUSCITATION PROCEDURES.

In 1988 the Royal College of Surgeons criticised the standard of trauma care and recommended that doctors managing trauma should undertake advanced trauma life support courses (ATLS). ATLS applies and expands upon the logical sequence of A=airway, B=breathing and C=circulation for resuscitation so that the injured patient is examined and resuscitated simultaneously. This one year prospective study examined the need for ATLS protocols in the Mersey Region, which has 16 admitting hospitals, by auditing the initial treatment of patients admitted alive with serious blunt chest trauma (AIS > 2). 275 patients were identified, mean age 46 (0-93) and 70% were male. Mean Injury Severity Score =36 and mean Revised Trauma Score =5.22.

Accidents were equally as common in urban and rural environments and 138 (50%) were involved in road traffic accidents.

On arrival 30% had clinical signs of haemodynamic shock and 60% abnormal respiratory effort recorded. However, only 74 (27%) had a cervical collar applied, 79 (29%) did not receive oxygen, and 173 (63%) did not have two large bore intravenous cannulae inserted. 171 (62%) did not have a urinary catheter inserted and 149 (54%) did not have arterial blood gas (ABG) estimation. 174 (60%) had blood cross-matched of which 14 (8%) were undertransfused.

109 patients arrived deeply unconscious (GCS<9). 72 (66%) had no cervical collar, 15 (14%) no airway protection, 13 (12%) no

oxygen, 48 (44%) less than 2 IV cannulae, 56 (51%) no urinary catheter and only 54 (50%) had ABG estimation.

140 (51%) of patients died.

CONCLUSION. Our ability in Mersey to perform the ABC of resuscitation is poor but likely to reflect the national trend. ATLS training and protocols should be implemented as soon as feasible to improve the basic standards of care.

THE ROLE OF MAGNETIC RESONANCE IMAGING IN THE EVALUATION OF
INJURIES IN THE PROFESSIONAL SPORTSMAN.

Magnetic Resonance Imaging (M.R.I.) is of great value in the assessment of soft tissue injuries in the musculoskeletal system. Poor availability and prohibitive cost (approximately £370 per scan) remain the predominant disadvantages of this new technique.

Professional sportsmen, in particular footballers, attract large transfer fees; injuries are common and lost matches through injury represents loss of financial resources for the club concerned. M.R.I. can therefore be justified in this group of patients and we present ten cases, all professional footballers, where M.R.I. proved of value in assessing their injuries.

M.R.I. studies were performed at the Liverpool University, Magnetic Resonance Research Centre using a 1.5T General Electric Signa System. T1 and T2 weighted pulse sequences were performed.

Muscle haematomas in adductor and hamstring muscles were identified allowing accurate targeting of ultrasound treatment, while resting only the affected muscle group. Compartment syndromes due to sub-clinical resolving haematomas were diagnosed.

Cruciate and knee collateral ligament injuries were clearly identified. Chronic tendo achilles tears are diagnosed and repair processes assessed.

Meniscal tears are evaluated and acute on chronic changes

Gillies, R.M., Klenerman, L., United Kingdom

differentiated avoiding arthroscopy and a potential four week absence from sport.

Players with acute on chronic back pain were scanned diagnosing chronic degenerative changes and acute disc prolapse.

M.R.I. is totally non-invasive and without biological hazard and the delay in return to training following arthroscopy, arthrography or radiculography can be minimised.

The concept of temporising is not a viable technique in the professional athlete and early diagnosis should be pursued.

It is believed that M.R.I. has a distinct role to play in the investigation of the injured professional athlete.

A COMPARISON OF THREE ROUTES OF SYSTEMIC ACCESS IN SEVERELY DEHYDRATED CHILDREN.

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Objective: To investigate three routes of systemic access for rehydration of severely dehydrated children.

Design: A prospective study of all eligible patients.

Setting: A British field hospital in Northern Iraq.

Type of participants: All children admitted with dehydration greater than 10%.¹

Measurements and main results: 9 children were admitted with dehydration > 10%. Systemic access was intravenous (IV, 6 patients), and/or intraosseous² (IO, 6 patients) and/or intraperitoneal cannulation³ (IP, 4 patients). 3 IV cannulations were not attempted. Fluid resuscitation was according to a defined protocol, with boluses and continuous infusions. The mean maximum initial flow rates of crystalloid were 240 ml/hour, 60 ml/hour and 400 ml/hour and the mean insertion times were 78, 62 and 28 seconds for IV, IO and IP routes respectively. One IV lasted more than 24 hours and three failed. One IO cannula blocked, and one IP was removed because of saline extravasation. IO bolus injections were painful. Total volumes infused and time to adequate hydration varied widely and there were no correlations. Mortality was 33%, compared with 11% for 18 less severely dehydrated children.

Conclusions: The I.P. and I.O. routes allow severely dehydrated children to be resuscitated by those unskilled in I.V. techniques without significant complications. The infusion protocol proved satisfactory, but requires further objective assessment.

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THE OBSTRUCTED AIRWAY.

S.Q.M. Tighe, The Anaesthetic Department, The Royal Naval Hospital Haslar, Gosport, Hampshire PO12 ZAA, for The Services Sound and Vision Corporation, Chalfont Grove, Chalfont St Peter, Gerrards Cross, Buckinghamshire SL0 8TN, United Kingdom.

This film is an aid to the instruction of Royal Naval paramedical personnel in emergency airway management of both the traumatised and non-traumatised patient. The obstructed airway is used as an example to demonstrate the range of techniques available, from the most basic to the most advanced, in a logical progression. Training in Basic Life Support is assumed.

The film opens with the clinical signs of normal respiration, followed by those of airway obstruction. The aetiology is divided into foreign body obstruction and airway deformation, the latter being dealt with first.

Simple manual methods are demonstrated on anaesthetised patients, including the chin lift, neck lift/head tilt, and the jaw thrust, followed by Guedel, nasopharyngeal and laryngeal mask airway insertion.

Oral endotracheal intubation is then demonstrated in detail, emphasising the indications and pitfalls.

Foreign body obstruction is managed by manual removal, the Heimlich manoeuvre and controlled suction. Cricothyroidotomy is vividly demonstrated on a cadaver with both the percutaneous and surgical approaches.

Finally, various simple methods of ventilation are applied, emphasising the single handed approach and including jet insufflation.

Illustrations are superimposed on normal surface anatomy where extra clarification is required and a booklet accompanies the film, including more detailed explanation and a flow chart.

The recommendations of the United Kingdom Resuscitation Council¹ and the American College of Surgeons' Advanced Trauma Life Support programme² have been merged and incorporated.

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MILITARY ANAESTHESIA.

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This amateur video demonstrates the actual administration of anaesthesia in a British field hospital in Northern Iraq. The first patient has shrapnel wounds to the lower limbs and receives a standard emergency anaesthetic with The Triservice anaesthetic apparatus¹. Preoxygenation, cr-sh induction and orotracheal intubation proceed to manual hyperventilation with oxygen, air, halothane and trichloroethylene. Vecuronium is administered and ventilation continued with the Cape TC 50 ventilator, using unsupplemented air. Monitoring is with the Propaq 104 system. Extubation is carried out in the lateral position and the patient followed to the ward. Real time is constantly displayed.

The second patient has a similar anaesthetic, but with isoflurane from a sole vaporizer.

Finally, the total intravenous technique of Restall² is demonstrated, using ketamine, midazolam, vecuronium, a syringe pump and controlled ventilation with air. The patient's recovery is followed as before.

The anaesthetist makes detailed comments about the technique as anaesthesia progresses, so that the viewer would be able to administer a field anaesthetic confidently by the end of the film.

The patients depicted have been filmed with their permission.

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VASOPRESSIN ON MYOCARDIAL CONTRACTILITY

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Vasopressin possesses antidiuretic and vasopressor properties. Other than in treatment of diabetes insipidus, vasopressin, a vasoconstrictor of splanchnic vessels, has been used not uncommonly in critical care for certain types of gastrointestinal bleeding. On the other hand, vasopressin may also cause coronary artery vasoconstriction and can result in myocardial depression. However, its direct effects on myocardium have not been clearly characterized. This study is to investigate the direct effects of vasopressin on myocardial contractility in isolated rabbit hearts.

Eight New Zealand white rabbits were used. The heart was immediately removed after i.v. pentobarbital. The first septal perforator artery was cannulated and perfused with warmed (37°C.) oxygenated (bubbled with 95% O₂, 5% CO₂) Krebs-Ringer bicarbonate buffer (KRB) solution at a rate of 1 ml/gm/min. The septum was then dissected out and suspended from a Grass FT03 tension transducer. The other two corners of the septum were fixed by two opposing clamps through which a 5-volt electrical stimulation was given at 1.5 Hz. Resting muscle tension was adjusted to 3-5 gm. Perfusion with vasopressin was then started at concentrations of 0.001, 0.01, 0.1, and 1 unit/ml. Each dosage was given for 5 min and plain oxygenated KRB solution was given in between as the control for 10 min. The peak developed tension (PDT) and the maximal acceleration (dT/dt) were recorded at the end of perfusion as % of control values. The results were analyzed statistically by Student's t-test for paired data.

| Vasopressin (unit/ml) | 0.001 | 0.01 | 0.1 | 1 |
|--------------------------|-----------|----------|----------|----------|
| PDT | 99 ± 0.7 | 97 ± 1.4 | 95 ± 0.9 | 56 ± 2.3 |
| dT/dt | 101 ± 1.8 | 98 ± 1.3 | 96 ± 1.4 | 56 ± 2.6 |

Because vasopressin may cause myocardial depression secondary to coronary vasoconstriction, it is not uncommon in current practice that nitroglycerin has been added in vasopressin therapy. Our study shows that only at very large doses, vasopressin demonstrates significant direct negative inotropic effect on myocardial contractility in rabbits.

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THE FRENCH AIRBONE SURGICAL UNITS

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The airborne surgical units illustrated the new trend in French military medicine. Sophisticated care performed by trained medical personnel including trauma anaesthesiologists and emergency physicians going forward on the battlefield. It is mandatory in a modern war, where highly-trained soldiers are involved not only to save the lives of casualties but also their limbs. A high standard of care is needed even in the initial phase of an airborne operation when evacuation to traditional field hospitals is not yet possible.

These light and very mobile medical surgical airborne units can provide very efficient medical support adapted to the various situations of a modern war. Their conception is based on a modular organization.

The Battalion Aid Station is dropped at the assault phase. The equipment needed is stored in individual and collective loading shaft and a light four wheel drive ambulance on a dropping platform. Medical personnel and the physician of the BAS are trained to manage life threatening emergencies.

The second phase is the deployment of the Airbone Surgical Unit. This parachuted light unit can work on a surgical or a triage mode. Its include 12 surgical and critical care beds with a medical team of 11 personnels , 2 surgeons , 1 trauma anaesthesiologist. The coupling of 2 surgical an 1 medical airborne units creates a light airborne field hospital.

The third phase is the air transport of the complementary supplies and personnels to obtain a full size field hospital close to the nearest safe airfield. Evacuation by air of casualties is then possible. The categorisation of casualties for air transport and in flight care is discribed. The original solutions to the logistical problems such as oxygen, blood , water supply are developed.

ROAD TRAFFIC POLYTRAUMA, MEDICAL MANAGEMENT

VIDEO FILM 1991

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The diagnosis and management of polymorphic road traffic and shock presents a continuing challenge to emergency medical services systems and to the personnel delivering care at the scene.

This video (1992) presents a systematic protocol for on-scene examination of the site, the vehicles and the casualties, emphasizing first the need to recognize and provide treatment for the maintenance of vital functions and second, the techniques of extraction.

The video then describes emergency department triage and care (tracheal intubation, perfusion, MAST, crural block), emphasizing the need for a high index of suspicion for covert life threatening lesions.

The video is targetted at immediate care first responders and is designed as an aid to introductory didactic teaching.

VIDEO FILM : 18 mm

STUDY OF DIFFERENT AUTOTRANSFUSION SYSTEMS

* * * *
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Transfusions using heterologous blood present a number of problems :

- risk of infection : AIDS, hepatitis, ...
- risk of non-availability for rare groups
- religious issues (Jehovah's witness)

In traumatology, the need is quite frequent in the case of thoracic and/or abdominal traumas. For this reason, most emergency care teams must be prepared to use the autotransfusion technique, even in pre-hospital situations.

For septicality reasons, abdominal traumas exclude this type of technique. However, thoracic traumas, especially those caused by fire arms, give an indication of criteria for the choice of autotransfusion practice.

Several technical set ups are possible :

1/ Connecting blood collection bags to the thoracic drain. This set up is simple, low cost, but the anticoagulants present in the collection bag perturb the ensuing blood coagulation especially as the blood in the pleural cavity is low in fibre.

2/ Other systems are possible with single use kits enabling to collect units of blood that are immediately retransfusable. These systems are practical but extremely expensive because they require a kit for each 500cc unit of retransfused blood.

3/ Another possibility consists of using a sterile bag for blood collection (of the type used for gastric or urinary liquid collection) but such systems do not conform to any technical standard.

4/ Finally, there is a system that enables blood collection in a reservoir linked to a vacuum source. The reservoir is connected to a bag that can be filled several times enabling the retransfusion of blood to the patient even for volumes of several liters.

Such techniques must be prepared with method and rigor in order to guaranty emergency care to the patient without risk of infection or embolism.

ERYTHROCYTE DEFORMABILITY IN PATIENT WITH UPPER AND LOWER EXTREMITIES REPLANTATION.

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We evaluate erythrocyte deformability before and after surgery in children with traumatic partial and full amputation upper and lower extremities by Radial Spreading Rheometer /1/ and factors influencing on deformability.

Erythrocyte deformability, Acid-Base balance, lactat and pyruvat levels were studied in 12 patient with traumatic partial and full amputation upper and lower extremities, complicated traumatic shock before and after surgery /1st group/, and in 11 patient with trauma upper and lower extremities without amputation and traumatic shock /2nd, control group/. Patients of 1st group were undergoing preliminary treatment traumatic shock and replacement of blood loss. Both group received premedication /diazepam 0,15 mg/kg IV and Droperidol 0,1 mg/kg/. After that, patient were anaesthezied with Ketamin 2-3mg/kg IV, intubated and mechanically ventilated. Anaesthesia was maintained with 50% N_2O in O_2 and Fentanyl 0,002 - 0,004 mg/kg. Patient were relaxed with vecuronium 0,1mg/kg. Mean age was $7,1 \pm 5,5$ years in 1st group and $7,6 \pm 5,8$ years in 2nd. RESULTS: Statistical analysis used t-test with p less 0,05

| | 1st group | 2nd group | 1st group | 2nd group |
|---------------------------|-----------------|-----------------|----------------------|-----------------|
| | before surgery | | after surgery 3d day | |
| erythrocyte deformability | $3,8 \pm 0,7$ | $1,8 \pm 0,4$ | $2,3 \pm 0,5$ | $1,6 \pm 0,4$ |
| Lactat /mmol/l | $3,4 \pm 0,2$ | $2,0 \pm 0,3$ | $2,4 \pm 0,4$ | $1,8 \pm 0,7$ |
| Pyruvat /mmol/l | $0,09 \pm 0,04$ | $0,04 \pm 0,02$ | $0,07 \pm 0,04$ | $0,04 \pm 0,03$ |

Discussion: There were appreciable differences between groups. Level of the erythrocyte deformability was higher in 1st group. Recovery of the normal level was more late and was correlated with lactat levels.

Conclusion: These data show, that using of the Radial Spreading Rheometer give the possibility evaluate rheological disturbance and can help in its correction.

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NASO-ENTERIC FEEDING IN THE CONSCIOUSNESS-IMPAIRED DOES NOT HAVE TO RESULT IN ASPIRATION PNEUMONIA

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Enteral feeding is well established as the preferred method of nutrition for most critically ill patients. In the critically ill or in those whose consciousness is impaired, gastric emptying and the ability to protect the airway are not reliable. Sitzmann has shown that when such patients receive nasogastric feeding approximately 10% of them will show signs of aspiration and of those who do 30% will go on to die. This is an unacceptably high rate of complications.

We wished to compare this experience to ours in which all the feeds are delivered well distal to the third portion of the duodenum. We reviewed our database of over 4000 critically ill tube-fed patients and selected those with major neurologic insult (head injury, subarachnoid hemorrhage, stroke etc.) The charts of those patients with a Glasgow coma score of 10 or less when first seen by the Nutrition support service were then pulled for further review. Patients meeting CDC criteria for pneumonia at the time of feeding tube placement were excluded. (Nineteen patients were thus excluded). This yielded 105 charts of patients seen between January 1988 and December 1990 for further examination. All the patients had feedings delivered to the fourth portion of the duodenum or more distally.

Average hospital length of stay was 56 days, average number of days of tube feeding was 25. Mean APACHE II score at feeding initiation was 12.5. At discharge in the survivors it was 4.8. Forty eight of the patients died (38%) - a mortality consistent with the severity of study inclusion criteria. Only two patients developed pneumonia in just over 1700 patient-days of tube feeding. In one of these patients this was attributable to surreptitious feeding of the patient by the family and in the other, after investigation, it was concluded on the basis of absence of feeding coloration from the sputum, that food aspiration had no causal role.

| | Age | Days to Feeding Goal | Daily Protein gm | Daily Calories | Apache II Score |
|--------|-----|----------------------|------------------|----------------|-----------------|
| Male | 68 | 4 | 107 | 2176 | 12 |
| Female | 66 | 5 | 82 | 1705 | 13 |

We conclude that naso-jejunal feeding can be given to neuro-logically impaired patients with no added risk of pneumonia.

PROSPECTIVE STUDY OF END TIDAL CO₂ MONITORING IN PREHOSPITAL CARDIOPULMONARY RESUSCITATION

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Recently, end tidal CO₂ monitoring (ETCO₂) has been evaluated during CPR, both in emergency room and in prehospital setting (1,2). The aim of this study was to evaluate the usefulness of ETCO₂ as a guide to resuscitation effort and prognosis in the prehospital setting.

METHODS : After institutional approval, 16 consecutive patients were resuscitated on the field after cardiac arrest. BLS was begun by firemen, and resuscitation was continued by a medical team including one of the authors : Patients in VF were at first defibrillated. All patients were intubated and mechanically ventilated, and ETCO₂ immediately measured and recorded by a portable infrared capnometer (Poet, Criticare System inc.). Patients in ventricular asystole received 5 mg endotracheal epinephrine before IV line and therapy. Resuscitated patients had stable hemodynamic status on admission. Non resuscitated patients were not transported to the hospital.

RESULTS : There was no difference regarding, age, previous history, and time onset of BLS and ACLS in resuscitated and non resuscitated patients. Two patients were in VF in resuscitated group, all others were in VA. ETCO₂ results during CPR are summarized in table 1 :

| ETCO ₂ | RESUSCITATED | NON RESUSCITATED |
|-------------------|--------------|------------------|
| (n=16) | (n=4) | (n=12) |
| Initial Value | 32 ± 4 | 31 ± 2 |
| Maximum Value | 40 ± 5 | 23 ± 8 |
| Mean Value | 30 ± 5 | 21 ± 4 * |

(values are expressed in mmHg, mean ± SD, * p < 0.01)

CONCLUSION : Initial ETCO₂ value seems not to be a reliable criterion to predict return to spontaneous circulation. Relatively high ETCO₂ values were recorded (mean values) which are well correlated to hemodynamic status during CPR. Maximum ETCO₂ value is higher in group of resuscitated patients, but values are lower than previously described (2). An acute elevation ("peak") of ETCO₂ before return of spontaneous circulation has been observed in only one patient (45 mmHg). Mean values show a significant difference between the two groups, and could be considered as a reliable guide for CPR efficiency and immediate outcome.

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ARTIFICIAL LUNG VENTILATION WITH HELIUM-OXGEN MIXTURES DURIG GENERAL ANESTHESIA

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ALV with traditional mixtures in spite of improving respirators, monitoring has definite drawbacks. One of the ways of solving some of these problems is the application of Helium. The comparative analysis of ALV is carried out in the closed system with He(131), N₂O (31) in combination with Calypsol, Fentanyl, Droperidol, Seduxen of patients aget 18-83, weight 40-143kg. wno were operated on abdominal cavity organs with concomitant systemic diseases in planned order. Relaxation was performed with Tuborin(64), Arduan(54), Tracurium(44).

| | ALV | | M [±] m | After extubation | | |
|----------------------------------|--------------------------------------|--------------------------|------------------|--------------------------------------|-------------------------|-----------------------------------|
| | He | N2O | | He | N2O | |
| 1. tc PO ₂ | 115.5 [±] 0.34 ⁺ | 110.4 [±] 0.87 | | 83.7 [±] 0.11 ⁺ | 76.1 [±] 0.56 | mm.Hg |
| 2. tc PCO ₂ | 33.1 [±] 0.08 ⁻ | 36.2 [±] 0.13 | | 33.2 [±] 0.06 ⁻ | 37.5 [±] 0.13 | mm.Hg |
| 3. F _I O ₂ | 30.2 [±] 0.32 ⁻ | 41.6 [±] 0.96 | | 21 (60) ⁺ | 21 (8) | % |
| | | | | 100 (71) | 100 (23) | % |
| 4. SaO ₂ | 98.4 [±] 0.13 ⁺ | 97.2 [±] 0.34 | | 97.5 [±] 0.26 ⁺ | 96.1 [±] 0.35 | % |
| 5. VO ₂ | 192 [±] 3.08 ⁻ | 235 [±] 9.17 | | 270 [±] 3.89 ⁻ | 303 [±] 9.09 | ml/min |
| 6. pH | 7.447 [±] 0.01 ⁺ | 7.421 [±] 0.009 | | 7.432 [±] 0.01 ⁺ | 7.398 [±] 0.08 | |
| 7. TV | 658 [±] 5.67 ⁺ | 602 [±] 16.1 | | 556 [±] 3.24 ⁺ | 430 [±] 12.6 | ml. |
| 8. MV | 5.6 [±] 0.08 ⁻ | 6.1 [±] 0.21 | | 8.9 [±] 0.08 ⁺ | 7.6 [±] 0.17 | l/min |
| 9. P _I | 13 [±] 0.35 ⁻ | 24 [±] 0.65 | | - | - | cm. ² H ₂ O |
| 10. PR | 78 [±] 0.53 ⁻ | 114 [±] 1.77 | | 86 [±] 0.6 ⁻ | 109 [±] 1.36 | min ⁻¹ |
| | p>0.01 (1,4,6,7) | | | p>0.01 (1,4,6,7,8) | | |
| | p<0.05 (8) | | | p<0.01 (2,5,10) | | |
| | p<0.01 (2,3,5,9,10) | | | p>0.05 χ^2 4.114(3) | | |

ALV in closed system with He/O₂ makes it possible to optimize ventilation and gasexchange regimen of patients with concomitant diseases of respiration, blood circulation and overweight. Restoring the spontaneous breathing isn't accompanied with complications. The use of relaxants is lowered by 35%. In postoperrational period no pneumonia, atelectasis, parasis of bowels are marked. Application of Helium deserves more large scale use in anaesthesiology and intensive therapy.

Management of Disasters in Third World

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Planning to contain the fury of disasters in the Third World countries e.g India, is far from satisfactory. But more than two-thirds of world's population lives in such countries and are more susceptible to civil, military unrest, natural calamities, but most importantly industrial accidents, involving large number of people.

Bhopal in India, Chernobyl in Russia are witnesses to the devastation of man-made horrors in recent times. These accidents also revealed many distressing aspects, one of which is their total lack of preparedness for the eventuality. The fact that an overwhelming number of accidents are waiting to happen as the industrial units are ageing due to overuse, makes one shudder to think. Bombay city in India teeming with its millions, industrialised to its teeth has a potential to become a vast burial ground, notwithstanding the fact that the existing means provided to care for the daily demands of acutely injured are grossly inadequate. The classical plea is that there are not enough resources. The realization that industrialisation has the potential to cause mass casualties and that the management of mass casualties is a matter of preparedness with very basic resources and awareness, is yet to sink into the minds of industrialists of these countries. In the context of disaster management, it must be understood that crucial factors such as time-lapse (how soon the Rescue Team arrived at the scene) and man-power needed to exercise triage and carriage of victims to safe distances *do not* need high-tech resources. Such resources must remain minimal requirements as they are invaluable in the event of mass-misadventure, which could easily be provided and maintained in good working order. It could be possible if only the managers of the industrial unit care to procure them and supply them to the civic authorities to be used exclusively for the job of rescuing victims of industrial mishaps. This is not to be confused with the preventive and curative aspects of workers health, safety and well-being.

The economic compulsions of recipient governments lead them to ignore the fact that exporting companies dump hazardous technology under the guise of aid. This is due to the overanxiety to improve the living standards of their people. But the inevitable consequences of death and destruction of people expose the fact that the supplier and the recipient disclaim any responsibility for the unpreparedness of potential hazards. They ignore the safety of the workers by pretending innocence or blaming each other.

As physicians of Acute Medicine we may have to interfere to ensure that Basic Life Supporting Systems are available within the crucial time and in adequate numbers, in a ready-to-use assembly and that they remain available irrespective of incident free history of the company. International bodies such as WFSA and ITACC must assume the role of policing that the supplier and the recipient of the industry stand answerable for the lapses that lead the workers into danger without preparedness (in the same manner as the Amnesty International acts to preserve Human Rights). We must take upon ourselves the task of preserving the life and limb of all workers.

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NORWAY

MAGNETIC RESONANCE IMAGING, DOUBLE CONTRAST ARTHROGRAPHY AND
ULTRASOUND IN THE INVESTIGATION OF SUSPECTED ROTATOR CUFF
INJURY.

A prospective study was established to compare magnetic resonance imaging (MRI), ultrasound and conventional double contrast arthrography in the investigation of suspected rotator cuff injury in patients with a painful arc syndrome. We report the first 20 cases in this study.

MRI is the first non-invasive technique to reliably define the spectrum of pathological changes in the rotator cuff associated with chronic impingement, such as tendinitis or tendon degeneration, and these changes are discussed.

Using double contrast arthrography as the standard for tear demonstration, MRI and ultrasound were by comparison less reliable. We accept that this initial study occurred early on our learning curve for these techniques but nevertheless we found both MRI and ultrasound technically difficult to perform and interpret.

We feel that MRI and ultrasound is likely to be of value when interpreted by clinicians using the techniques frequently for the investigation of shoulder pain. Double contrast arthrography is easier and more reliable to interpret.

TOTAL PARENTERAL NUTRITION IN A DEVELOPING COUNTRY

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Total parenteral nutrition (TPN) is indicated when nutrition by enteral route is either impossible or contraindicated. Though TPN is practiced almost routinely in developed countries, it remains mostly a theoretical treatment modality in developing countries for lack of technical skill, nonavailability of costly intravenous nutrients, inadequate laboratory support etc. In Bangladesh, there is no documented report of TPN. In Combined Military Hospital Dhaka, we have been practicing TPN on a limited scale since 1988. The endeavor started from saving a child of 5 years who was suffering from multiple entero-cutaneous fistula due to necrotising enterocolitis with considerable success. Till March 1992, we have provided TPN to 20 patients.

This paper reports a prospective analysis of these patients. After successful administration of TPN in first patient, a TPN protocol was designed keeping the available facilities in view. All patients posted for TPN were investigated to establish a baseline. These included record of body weight, exclusion of vital organ failure, complete blood picture, blood sugar & protein profile and a check X-ray chest. A central line with 16-18 G PTFE catheter via subclavian, external jugular or basilic vein was established in each patient. A combination of 10-20% intralipid, 5% nutrisol, 25%/40%/70% glucose was used in various ratio and volume depending on the total calorie requirement and the volume of fluid, the patient could tolerate. All were given low dose heparin. 20 mEq of KCl and 10 units of soluble insulin were added to each 50 g of glucose infusion. Blood sugar and electrolytes were estimated 6 hourly. Blood urea, creatinine, LFT with protein profile alongwith record of body weight and x-ray chest were done every 4th day. They were kept under a broad spectrum antibiotic during the period of treatment.

Indications for TPN were: enterocutaneous fistulae-2, biliary fistulae-2, preoperative preparation of oesophageal carcinoma-2, postoperative nutritional support in oesophageal resection-4, postextubation period following prolonged artificial ventilation-9, tracheo-oesophageal fistula-1. Duration of TPN ranged from 3-10 days. 8 patients showed weight gain by 1-4 kg, 5 patients had almost static body weight while 7 patients had progressive weight loss inspite of TPN. 7 patients expired while 13 patients recovered from acute illness. No major complication due to TPN was recorded in these patients. Estimated cost ranged between \$ 40-60. Considering the severity of the disease processes and positive effect of TPN on the outcome of these patients, we consider TPN quite cost-effective.

TPN in developing countries is handicapped with non-availability of high calorie solution & too high cost of the available agents. Local production of these items may help ailing patients tremendously, many of whom at present, probably die of poor nutrition only. More and more hospitals should start practicing TPN in deserving patients with whatever means available.

GRADED HEMORRHAGE DURING PROPOFOL ANAESTHESIA.

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The physician who takes care of the critically ill patients is often faced with the problem of evaluating their effective intravascular volume. This evaluation, which is a key-factor in therapeutic decision-making, appears more difficult during anaesthesia. In fact anaesthetics influence cardiovascular responses to stresses such as hemorrhage. In the present investigations, real-time hemodynamic monitoring was performed in normovolemic animals and during hemorrhage to detect the degree of correlation between common hemodynamic parameters and hypovolemia during propofol anaesthesia.

Ten Large-White piglets (20-25 Kg) were intubated and ventilation controlled. Afterwards five awake, unmedicated piglets (group A) were compared with five anaesthetized with propofol (2 mg/Kg plus 10 mg/Kg/h) (group B). Each group was evaluated during normovolemia (N) and during five sequential steps of 10 minutes' blood removal of 10 ml/kg each (-10,-20,-30,-40,-50). Mean Arterial Pressure (MAP), Pulmonary Arterial Pressure (PAP), Heart Rate (HR) and Mixed Venous Oxygen Saturation (SvO₂) were transduced and HR : MAP ratio (Shock Index, SI) derived. Real-time data acquisition was performed using a single-board analogical data-acquisition and control system (Burr-Brown PCI-20000) installed into a IBM-compatible personal computer (Toshiba T5200). Data management and statistical elaboration were carried out employing the software packages Labtech Notebook (Laboratory Technologies), Microsoft Excel 3.0 and Statgraphics Statistical Graphic System.

Hemodynamic data summarized in the following table refer to the mean (SE) of the values acquired over each 10' step.

| | Groups | N (1) | -10 (2) | -20 (3) | -30 (4) | -40 (5) | -50 (6) | Statistics |
|------------------|--------|-------------|-------------|-------------|-------------|-------------|------------|---------------|
| MAP | A | 136 (0.8) | 135 (0.7) | 132 (0.7) | 123 (0.9) | 90 (2.5) | 65 (2.4) | 1,2,3>4>5>6 |
| | B | 113 (0.7) | 111 (0.8) | 92 (1.8) | 66 (1.4) | 53 (1.3) | 44 (1.5) | 1,2>3>4>5>6 |
| PAP | A | 25 (0.4) | 21 (0.1) | 19 (0.1) | 18 (0.2) | 14 (0.1) | 15 (0.2) | 1>2>=3>=4>5,6 |
| | B | 23 (0.4) | 22 (0.2) | 24 (0.9) | 15 (0.2) | 13 (0.4) | 16 (0.4) | 1,2,3>4,6>5 |
| HR | A | 139 (2.3) | 145 (1.2) | 161 (0.8) | 187 (1.8) | 215 (1.2) | 227 (1.2) | 1,2<3<4<5<6 |
| | B | 154 (2.4) | 151 (3.2) | 167 (1.8) | 167 (2.4) | 185 (2.6) | 219 (4.6) | 1,2<3,4<5<6 |
| SvO ₂ | A | 84 (0.3) | 79 (0.3) | 73 (0.3) | 62 (0.6) | 38 (0.8) | 26 (0.6) | 1>2>3>4>5>6 |
| | B | 74 (0.7) | 69 (0.6) | 59 (1.2) | 47 (1.1) | 47 (1.3) | 31 (1.5) | 1>2>3>4,5>6 |
| SI | A | 0.99 (0.01) | 1.03 (0.01) | 1.19 (0.01) | 1.49 (0.02) | 2.44 (0.07) | 3.57 (0.1) | 1,2,3<4<5<6 |
| | B | 1.3 (0.02) | 1.29 (0.03) | 1.94 (0.04) | 2.85 (0.08) | 3.93 (0.13) | 5.38 (0.2) | 1,2<3<4<5<6 |

In group B MAP shows an inverse linear correlation ($r=-0.83$) with hypovolemia, whereas in group A MAP remains unchanged until -30 ($r=-0.76$). PAP and HR trends well correlate with hypovolemia in group A ($r=-0.79$ and $r=0.88$), while poor correlations are detected in group B ($r=-0.52$ and $r=0.44$). During graded hemorrhage SvO₂ deterioration well corresponds in degree to the amount of hypovolemia in group A ($r=-0.92$) and, to a lower extent, in group B ($r=-0.69$). SI increase is similar in both group ($r(A)=0.77$ $r(B)=0.74$). In conclusion hypovolemia is well tolerated during propofol anaesthesia and MAP (and SI) is a good index of the degree of hypovolemia and of the consequent decrease of oxygen transport to the peripheral tissues.

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**WEANING FROM CARDIOPULMONARY BYPASS WITH INTRAVENOUS PIROXIMONE:
RESULTS OF THE EUROPEAN MULTI-CENTER STUDY**

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Piroximone is a new non-glycoside, non-catecholamine imidazolone derivative with both positive inotropic and vasodilator properties. Post cardiac surgery 45 patients (35 male, 10 female) received single bolus dose of 0.5 mg/kg bodyweight piroximone in assisting weaning from cardiopulmonary bypass (followed by continuous infusion of 5-8 µg/kg/min in 10 patients). Haemodynamic parameters were measured using Swan-Ganz-catheter immediately before the bolus and after 15, 30, 50 and 60 min.

| OPERATION TYPES | | | |
|---------------------|------|--------------------------------|---|
| coronary-aorto- | 33 | mitral valve replacement (MVR) | 4 |
| bypass-graft (CABG) | | aortal valve replacement (AVR) | 3 |
| - 1-vessel | (5) | combined AVR + MVR | 1 |
| - 3-vessels | (24) | AVR + 3-vessels CABG | 3 |
| - 4-vessels | (4) | MVR + AVR + 3-vessels CABG | 1 |

| DEMOGRAPHIC AND SURGICAL DATA | | | |
|-------------------------------|--------------------------|------|--|
| Age | 63.0 ± 7.8 yrs (46 - 79) | CI | 2.1 l·min ⁻¹ ·m ⁻² |
| CPB | 115 ± 39 min (40 - 236) | PCWP | 15 mmHg |
| Cross Clamp | 59 ± 26 min (21 - 155) | BSA | 1.83 m ² |

Maximum effects were mostly seen after 30 min: median cardiac index increased significantly (**) by 32% compared to baseline values; whereas pulmonary capillary wedge pressure (-13%; **), right atrial pressure (-7%), mean pulmonary artery pressure (-15%; *), pulmonary vascular resistance (-44%; **) and systemic vascular resistance (-37%; **) decreased (* p<0.05; ** p<0.01). Mean heart rate (**) and mean arterial pressure (**) changed by +33% and -8%, respectively, 30 min after bolus application.

| ADVERSE EVENT | FREQUENCY | COUNTERACTIVE INTERVENTION |
|----------------------|-----------|---|
| lack of efficacy | 7 (16%) | 1 prolonged IAPB 6 nitrogly. and/or catecholamines |
| hypotonia | 1 (2%) | prolonged IAPB and catecholamines |
| moderate tachycardia | 1 (2%) | none |

No adverse events on laboratory parameters or life-threatening arrhythmias occurred that were related to the study drug..

It is concluded that a single dose of 0.5 mg/kg piroximone in addition to conventional therapy is safe and effective for use in weaning patients from CPB. Further comparative studies are indicated.

FLAIL CHEST AND PULMONARY CONTUSION: INDIVIDUALIZED SELECTIVE MANAGEMENT-AVOIDANCE OF MECHANICAL VENTILATION WITH PAIN RELIEF, FLUID RESTRICTION AND VIGOROUS PULMONARY CARE

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Flail chest and pulmonary contusion continues to be an important source of morbidity and mortality. The treatment of multiple rib fractures and pulmonary complications remains controversial. The concept of selective management introduced by Trinkle et al. in 1975, was the background of our management strategy. Endotracheal intubation with controlled mechanical ventilation was selectively performed in patients with hypoxia and respiratory distress, serious extra -thoracic injury, manifested shock, bilateral flail chest and elder patients (age over 50).

Continuous epidural fentanyl analgesia and intercostal nerve blocks with bupivacain, was routinely administrated together with vigorous supportive measures - adequate pulmonary toilet and maintenance of intravascular volume within strict limits.

54 patients were treated in Intensive Care unit because of flail chest and pulmonary contusion, between March 1, 1987 and March 1, 1991. 41 patients were victims of motor vehicle accidents (76%), 4 were injured in falls from heights (7,5%) and nine (16,5%) were victims of occupational accidents. Six patients (11%) had bilateral flail chest, twelve had important extrathoracic injuries and seventeen (31,5%) had 8+ ribs fractured.

32 patients (59%) required intubation and mechanical ventilation, but 27 patients (50%) were intubated less than 3 days.

22 patients (41%) were treated by nonintubation. 20 patients in this group had successful outcome (91%), while two required intubation. None patient died in this group. The incidence of pneumonia was relatively small, (27%), and we did not have tracheostomy complications.

This study demonstrates that selective management of flail chest and pulmonary contusion is safe and effective strategy associated with important reduction in incidence of complications, connected with intubation and mechanical ventilation.

MILRINONE (MIL) VERSUS NITROGLYCERIN (NTG) IN THE PREHOSPITAL TREATMENT OF HYPERTENSIVE PULMONARY EDEMA (HPE).

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Introduction: NTG is widely used for the treatment of pulmonary edema because of its coronary and predominantly venous vasodilating actions. MIL, a phosphodiesterase inhibitor, combines a predominant arterial vasodilation with an inotropic property. This study was designed to compare clinical patterns and hemodynamic response to these agents in the prehospital management of HPE.

Materials and methods: 15 patients (70 yrs \pm 13 SD) with HPE were studied at home by the Emergency Medical Unit Team. Exclusion criteria: 1/ prior history of renal failure, mitral or aortic stenosis 2/ severe cardiac dysrhythmia 3/ clinical and electrical signs of acute myocardial infarction. After nasal oxygenotherapy and intravenous (IV) furosemide administration (1 mg/kg), patients were randomly assigned to either NTG (.25 mcg.kg⁻¹.min⁻²) or MIL (1.5 mcg.kg⁻¹.min⁻²). The following variables were measured or evaluated just before (Baseline=B), 5, 15 and 30 min after the beginning of infusion: 1/ non invasive systolic (SAP), diastolic (DAP) and mean (MAP) arterial pressures (Dinamap); 2/ heart rate (HR); 3/ respiratory rate (RR); 4/ dyspnea (DYS), crackling rales and cyanosis (CYA) quoted 0 or 1 according to their presence; 5/ arterial oxygen saturation (SaO₂) (CRITIKON pulse oxymeter). At B and T 30 min, velocity from the ascending aorta (AoV) was measured (4 MHz Pulsed Doppler) (1), as an indirect parameter of cardiac output and blood samples were collected to measure epinephrine (E) and norepinephrine (NE) using a radio-enzymatic assay. Statistics were performed by analysis of variance and T-test.

Results :

| | | N | BASELINE | T 5 MIN | T 15 MIN | T 30 MIN |
|----------|-----|---|-----------------|----------------|----------------|----------------------|
| SAP | TNT | 7 | 156 \pm 25 | 141 \pm 22* | 138 \pm 24* | 141 \pm 27* |
| mmHg | MIL | 8 | 174 \pm 29 | 159 \pm 26\$ | 153 \pm 25\$ | 146 \pm 23 |
| DAP | TNT | 7 | 104 \pm 24 | 94 \pm 14 | 94 \pm 15 | 96 \pm 16 |
| mmHg | MIL | 8 | 99 \pm 10 | 91 \pm 10 | 86 \pm 13 | 84 \pm 8*\$ |
| MAP | TNT | 7 | 133 \pm 29 | 120 \pm 24* | 119 \pm 25* | 121 \pm 26 |
| mmHg | MIL | 8 | 125 \pm 12 | 115 \pm 15 | 110 \pm 17 | 106 \pm 13*\$ |
| AoV | TNT | 6 | 97 \pm 14 | | | 77 \pm 16** |
| cm.sec-1 | MIL | 5 | 94 \pm 21 | | | 125 \pm 13\$\$ |
| NAR | TNT | 6 | 2117 \pm 1232 | | | 1854 \pm 1044 |
| peg.ml-1 | MIL | 5 | 1645 \pm 272 | | | 1077 \pm 230**\$\$ |
| EPI | TNT | 6 | 268 \pm 330 | | | 124 \pm 65 |
| peg.ml-1 | MIL | 5 | 423 \pm 361 | | | 190 \pm 106 |

* p < .05 vs B ; ** = p < .01 vs B ; \$ p < 0.05 ; \$\$ p < .01 MIL vs NTG

Discussion: The decrease in SAP and AoV obtained with NTG was associated with unmodified NE levels. This might result from a predominant venodilating action. In contrast, MIL decreased DAP but did not change AoV, whereas sympathetic hyperactivity was decreased. This suggests that the predominant arteriolar dilator of MIL seems more adapted to HPE in order to maintain peripheral perfusion.

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ASSESSMENT OF SPLANCHNIC METABOLISM DURING SEPSIS BY STABLE ISOTOPE TECHNIQUE - EFFECTS OF HYDROXYETHYLSTARCH AND DOPAMINE THERAPY

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Introduction:

Splanchnic dysfunction plays a pivotal role in the development of multiorgan failure. Maintenance and monitoring of the functional integrity of these tissues should be a major goal of modern intensive care medicine. Currently arterial and venous blood oxygenation, cardiac output and blood pressure represent the main monitoring parameters in an intensive care setting. These parameters though are not organ specific. Stable isotope technique allows the evaluation of organ specific metabolic function in a noninvasive manner. We therefore evaluated splanchnic metabolic status twelve hours after abdominal surgery. Additionally we then monitored the effects of hetastarch (H) and dopamine (D) on hepatic glucoseproduction (HGP), first pass effect (FPE) and leucine oxidation (LO) in these septic patients.

Methods:

Eight patients (age between 32 and 58) suffering from abdominal sepsis and requiring artificial ventilation were given a primed constant infusion of 6,6-D2-glucose and D3-leucine intravenously, twelve hours after surgical intervention. Additionally we applied 1-C13-leucine via a jejunal tube. In isotope plateau, after three hours of infusion, baseline values were obtained. Next samples were drawn after a hetastarch volume challenge, establishing a pulmonary wedge pressure of 15 mm Hg. Following the hetastarch administration a dopamine-infusion at a rate of 6 µg/kg BW/min was started. Another three hours later a final set of samples was collected. Measurements of stable isotope enrichment in plasma were performed using a GCMS (HP-5890, HP-5970). The expiratory 13-CO₂ enrichments were measured in a IR-MS (3-60 RMS, Nuclide Corp.).

Results:

| # p < 0,05 vs Basal | Basal | After H | After H+D | Normal |
|---------------------|------------|-------------|-------------|-------------|
| HGP mg/kg BW | 10,2 ± 1,9 | 7,6 ± 1,2 # | 4,8 ± 0,6 # | 2,1 ± 0,2 # |
| FPE % | 12 ± 2 | 16 ± 5 | 22 ± 6 # | 27 ± 2 # |
| LOX µmol/h | 2,1 ± 1,7 | 2,6 ± 1,8 | 2,8 ± 2,2 # | 3,4 ± 1,9 # |

Conclusions:

Metabolic effects of standard intensive care regimes are still an area of little pathophysiologic insight. Our results indicate a markedly alteration of metabolic liver function in ventilated septic patients after surgery. Compared to normals a fivefold elevated HGP was observed, whereas FPE and LO was significantly depressed. Combined application of hetastarch and dopamine reversed this pathological situation, and lead to restoration of almost normal levels. Improved hepatic oxygendelivery and increased splanchnic tissue perfusion are possible causative mechanisms for these beneficial effects. Future research will yield new information on metabolic sequelae of intensive therapy and thereby give rise to a more differentiated therapeutic approach to the individual clinical situation.

DISCREPANCY BETWEEN LATERAL WALL PRESSURE AND INTRACUFF PRESSURE

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The practice of monitoring intracuff pressure to prevent pressure ischemia of the tracheal mucosa is good but may be misleading. Strictly speaking, it is the lateral wall pressure (LWP) the cuff exerting not the intracuff pressure (ICP) itself that causes tracheal damage. We used a tracheal model to investigate the correlation between LWP and ICP in different size Rusch endotracheal tubes.

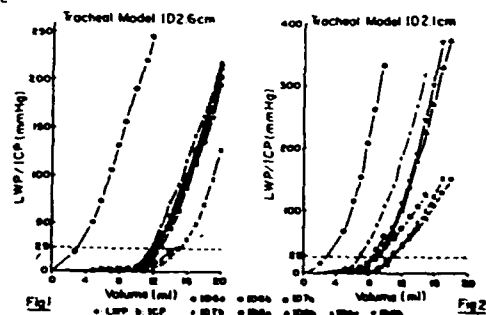
1. Measurements of the compliance of cuffs in different size tubes (Rusch tube, ID 6-9mm). The cuffs were inflated to the minimum fully expanded volume (MFEV, the volume when there were no more wrinklins of the cuff), while the length, diameter and pressure (ICPa) were measured.

2. Correlations between LWP and ICP. Two different size syringe barrels were used as tracheal models (30-ml/ID 21mm, 50-ml/ID 26mm). A small balloon was stuck to the wall inside each syringe barrel for lateral pressure recording. The ET tube was inserted into the syringe barrel so that the midpoint of the cuff was positioned against the LWP balloon. With Physio-Control monitor, the LWP and ICP were recorded simultaneously when cuffs were inflated by increments of 1 ml. Each tube was tested in the two different size tracheal models. The ICP-LWP gradients were measured when either ICP or LWP was 25 mmHg. The results are summarized in the table and Figs. 1 and 2.

Theoretically, as long as the pressure exerted to the wall does not exceed the capillary pressure (25 mmHg), ischemic damage to the trachea by cuff can be avoided. ICP monitoring has been recommended for that reason. However, due to different cuff designs, compliances, shapes as well as sizes, which are not necessarily proportional to ET tube size even in the same brand, ICP may not always appropriately reflect the LWP. Our study showed that the correlation between these two pressures was poor and gradients between them were unpredictable with different size ET tube in different size trachea. Clinically, the distensibility of the trachea even makes the estimation of LWP from ICP almost impossible. ICP of 25 mmHg does not necessarily cause pressure ischemia.

| Size | MFEV (ml) | L (cm) | D (cm) | ICPa (mmHg) | Cc (ml/mmHg) | ICP = 25 (mmHg) | | LWP = 25 (mmHg) | |
|------|-----------|--------|--------|-------------|--------------|-----------------|---------|-----------------|---------|
| | | | | | | LWP 2.1 | LWP 2.6 | ICP 2.1 | ICP 2.6 |
| 6 | 2.5 | 2.2 | 1.2 | 22 | 0.11 | 0 | 0 | 233 | 296 |
| 7 | 18.3 | 3.5 | 2.7 | 24 | 0.76 | 18 | 12 | 58 | 45 |
| 8 | 22.2 | 4.2 | 3 | 25 | 0.88 | 8 | 23 | 54 | 28 |
| 9 | 13.0 | 4 | 2.2 | 23 | 0.56 | 15 | 3 | 62 | 82 |

L - Length, D - Diameter, Cc - Cuff compliance



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POSTERIOR FOSSA HEMATOMA AND STREPTOCOCCAL MENINGITIS: A CONCURRENT PRESENTATION

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INTRODUCTION: Epidural hematoma in the posterior fossa is rare and often not suspected when traumatic head injury occurs. Several large studies suggest that 0.2 to 0.3% of traumatic, space occupying hematomas occur in the posterior fossa.^{1,2} Other studies suggest that 50% of these are extradural.³ Even more rare is the occurrence of meningitis concomitant with an epidural hematoma. An exhaustive search of the literature reveals no previous published reports of this unusual combination. The present case documents an initial recording of posterior fossa epidural hematoma which presents in combination with pneumococcal meningitis.

CASE REPORT: Our patient is a 35 year old American Indian male who tripped over a curb and fell and hit the back of his head and briefly lost consciousness. He complained of headache and presented the following day to another hospital with complaints of headache and difficulty walking. CT scan performed at that time was reported as normal. He was observed for six hours then released. He continued to have pain and increasing difficulty walking the remainder of the day. He became increasingly somnolent until the next day when he was unable to get out of bed. He was brought to our facility by ambulance the next morning.

Physical examination showed a well developed, thin male who was in a moderate amount of distress. He opened eyes spontaneously but was either unwilling or unable to talk. On occasion he would grab for his head with accompanying facial grimacing. Some nuchal rigidity was present. Pupils were 3-4+/4+ and very brisk. Neurologic examination showed the patient to be very uncooperative. He withdrew from pinprick in all extremities. Unable to assess Babinski due to patients withdrawal. Labs on admission showed a white blood cell count of 45,700 with 59% neutrophils and 34% bands. Repeat CT scan showed a radiodense lesion in the left occipital area. A craniotomy was performed in the area of the right posterior fossa. An epidural hematoma was evacuated uneventfully and the patient was transferred to the ICU. A lumbar puncture was performed. Cell count showed 1100 RBC's and 8900 wbc's with 94% neutrophils, 2% lymphocytes, and 4% monocytes or histiocytes. Gram stain showed many neutrophils and many gram positive diplococci suggestive of *Streptococcus pneumoniae*. The patient was begun on 3,000,000 units of penicillin G every four hours and Vancomycin, 1 gram every twelve hours. The patient progressed well during his hospitalization and was released on post operative day number nine.

DISCUSSION: Epidural hematoma in the posterior fossa is rare and an often neglected diagnosis when brain injury occurs. Overall, less than 200 cases have been published since 1901.¹⁻⁵ CT scanning has caused a real revolution in the diagnosis and early management of subtentorial extradural hematoma. Before the development of the CT scanner, only the appearance of cerebellar symptoms or the involvement of one or more lower cranial nerves indicated that such a lesion might exist. Prior to 1975, a mortality rate of 75-100% was common.^{6,7} Survival rates of 50-70% are prevalent since a precise and early diagnosis of this type of brain injury has been made possible.⁸

Mortality remains high, although an improvement has occurred since the CT scan was introduced. Mortality rates continue around 20-50%.^{1,4,7} High mortality is caused less by the hematoma itself than by concomitant injuries of the brainstem or basal ganglia.

CONCLUSION: We have presented here a case of posterior fossa epidural hematoma found in conjunction with a streptococcal meningitis. This simultaneous presence of an associated meningitis has not been previously reported.

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SIMILAR REACTIONS OF TWO ANIMAL GROUPS WITH SEPTIC SYNDROME

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Introduction

The objective of our study was to examine, whether animals with infections in their early life and animals of a "minimal-disease" stock show similarities in their reactions to endotoxin.

Material and Methods

The study was performed with 14 domestic pigs with a body weight between 30 and 35 kg. 7 animals (group 1) received E.coli endotoxin by continuous infusion. The animals of group 2 originated of a minimal disease stock. They received endotoxin three times in a short infusion. Intravascular volume was stabilized with Ringer's solution and HES 200/0.5. By catecholamines only dopamine was given to protect the kidneys. Mean arterial and mean pulmonary-arterial blood pressure were registered continuously. Every two hours cardiac output, pulmonary and systemic resistance were calculated.

Results

All animals of group 1 survived 24 hours, but only two 48 hours. In group 2 all animals reached the end of the experiment after 48 hours. Cardiac output, pulmonary and systemic resistance showed a similar course during the first 15 hours. Only in group 1 mean arterial blood pressure decreased after the first hour. Mean pulmonary arterial blood pressure fell in the same manner.

Discussion

The two groups differ in origin of the animals, endotoxin amount, and endotoxin infusion mode. Hence they could not be comparable. But the hemodynamic parameters showed a similar course except the mean arterial pressure. The relation of arterial to pulmonary arterial pressure remained unchanged. It seems that endotoxin initiated the septic syndrome. The further progress is independent of the time course of additional noxae. The fact that animals with the lower arterial pressure die earlier, implied that this pressure is a good parameter to estimate the severity of the septic syndrome.

CORRELATION BETWEEN CARDIORESPIRATORY CHANGES AND HISTOLOGICAL FINDINGS IN EMBOLI WITHDRAWN FROM THE RIGHT ATRIUM DURING CEMENTED HIP ARTHROPLASTY

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Introduction: Surgery induced central embolism is considered to be the main reason for cardiopulmonary changes during cemented hip arthroplasty [1]. However, the content of embolised material in humans found during hip arthroplasty has not been studied so far. The aim of our study was to identify the moment of central embolisation by means of Transoesophageal Echocardiography (TEE) and to examine embolised material obtained from the right atrium.

Patients and methods: 7 patients, age 81-91 years, ASA 3-4, scheduled for cemented hip surgery were studied. A 14 Ga. catheter was inserted into the right atrium via the right jugular vein. Anaesthesia was performed using fentanyl, thiopentone, vecuronium and isoflurane. Patients were ventilated with 50 percent nitrous oxide in oxygen. Monitoring included continuous measurements of ECG, peripheral oxygen saturation (SAT; pulsoxymetry) and mean arterial blood pressure (MAP). Arterial blood gases were controlled 10 min after induction (A), immediately after start of embolisation (B), 6 minutes afterwards (C) and before skin closure (D). TEE probe was placed to achieve four chamber view. When embolisation was noticed, a probe of 50 ccm blood was withdrawn from the right atrium and material was examined histologically.

Results: There was a significant decrease in MAP ($p < 0.05$), whereas only slight changes were seen in partial pressure of arterial oxygen and carbon dioxide (pO_2 , pCO_2), heart rate (HR) and SAT. The histological examination yielded bone marrow particles, activated thrombocytes and granulocytes.

| | | A | B | C | D |
|---------|-----------|--------|---------|----------|---------|
| HR | beats/min | 86±6.2 | 86±5.9 | 81±4.9 | 77±3.7 |
| MAP | mmHg | 94±4.0 | 99±7.8 | 80±3.0* | 83±3.8 |
| SAT | % | 99±0.5 | 99±0.1 | 98±0.5 | 99±0.4 |
| pO_2 | mmHg | 160±16 | 161±8.2 | 142±10.3 | 139±8.4 |
| pCO_2 | mmHg | 39±1.0 | 37±1.6 | 39±1.7 | 40±2.2 |

* $p < 0.05$ compared to A (Wilcoxon Test for matched pairs)

TAB.: mean ± SEM

Conclusion: Our preliminary data suggest that cardiorespiratory changes during cement implantation were caused by central embolism of bone marrow but not by acrylic bone cement particles.

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THE AZEOTROPIC MIXTURE OF HALOTHANE-DIETHYL-ETHER DO NOT DEPRESS REGULATION OF VENTILATION IN CONTRAST TO ISOFLURANE

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It has been claimed but not shown that the regulation of breathing is maintained during halothane-diethyl-ether azeotrope (HE) anaesthesia (1). This could make the HE an attractive anaesthetic during difficult or primitive circumstances such as civil disaster or war. We have already shown that the central circulation is well maintained despite significant blood loss (2). The present purpose was to evaluate the influence of general anaesthesia with the HE or Isoflurane (ISO) on the regulation of ventilation.

12 patients undergoing minor orthopaedic surgery were included. They were randomly allocated to the HE group (n=6) or the ISO group (n=6). There was no difference in general characteristics between the groups. Evaluation of resting ventilation and ventilation stimulated by hypercarbia and hypoxaemia (3) was done on three occasions: (A) before anaesthesia, (B) after inhalational induction of anaesthesia and intubation (without muscle relaxants) when the level of anaesthesia was 1.3 MAC (4) with the patients breathing spontaneously and finally (C) about 30 minutes after end of operation, during recovery of anaesthesia.

We found that there was no difference in resting minute ventilation before anaesthesia as compared with during anaesthesia in the HE group: 7.5 ± 0.9 compared with 6.4 ± 1.4 l/min (mean \pm SD). In the ISO group resting ventilation decreased significantly, 6.7 ± 1.4 before compared with 4.6 ± 1.9 l/min during anaesthesia ($p < 0.05$). The increase in carbon dioxide tension during anaesthesia (resting ventilation) was significantly higher in the ISO group compared with HE group ($p < 0.001$): 8.3 ± 0.9 compared with 6.4 ± 0.2 kPa. Furthermore, there was no difference in the ventilatory response to hypercarbia during anaesthesia in the HE group. In the ISO group, however the response to hypercarbia decreased significantly ($p < 0.01$) (see Fig.1.). The response to hypoxaemia decreased in both groups.

Our conclusion is that general anaesthesia with halothane-diethyl-ether does not impair ventilation or the regulation of ventilation as much as general anaesthesia with isoflurane.

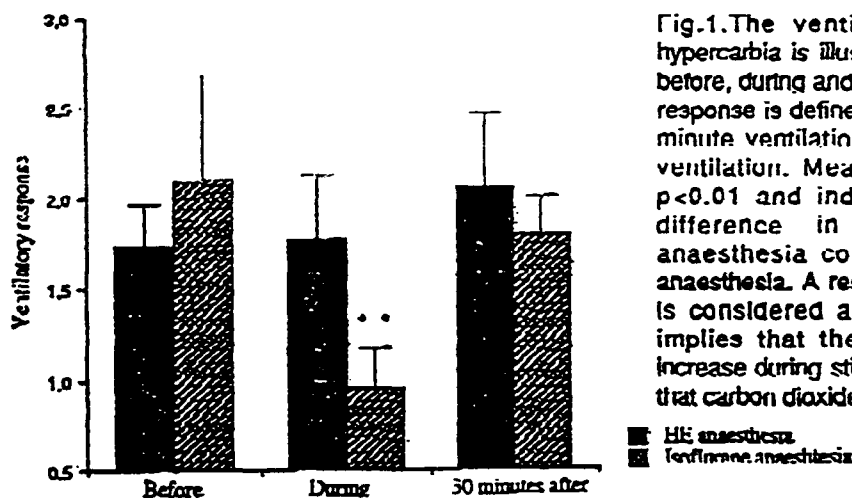


Fig.1. The ventilatory response to hypercarbia is illustrated for both groups before, during and after anaesthesia. The response is defined as the ratio between minute ventilation and resting minute ventilation. Mean \pm SD is shown. ** = $p < 0.01$ and indicates a significant difference in response during anaesthesia compared with before anaesthesia. A response ratio below 1.2 is considered a poor response and implies that the normal ventilatory increase during stimulation is absent and that carbon dioxide retention will follow.

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DOES LOCUS OF CONTROL INFLUENCE EFFICACY OF PHARMACOLOGIC AND NONPHARMACOLOGIC PAIN CONTROL? *

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Pain is one of the most challenging areas facing Nursing and Medicine today. The purpose of this study is to examine three methods of pain relief and to determine if the patient's psychological makeup would affect their analgesic qualities. This study is a mixed 2 X 3 X 2 factorial model of experimental design. One hundred twenty seven patients scheduled to undergo laporatomy at a large teaching hospital were included into the study. Following consent, the patient's locus of control was determined and randomly assigned to one of three groups of pain relief: pharmacologic, cognitive-behavioral or somatophysiologic. They were further randomly assigned to the method of pharmacologic dosing, patient controlled analgesia (PCA) or intermittent (INT) dosing. Patients assigned to the cognitive-behavioral group received positive auditory stimulation of a tape recorded message while under general anesthesia, suggesting minimal postoperative discomfort, etc. Patients assigned to the somatophysiologic group had the use of a transcutaneous nerve stimulator (TENS) postoperatively. It was hypothesized the patient's pain perception, amount of analgesia and complication rate would be affected by locus of control, method of administration and adjunctive pain relief modalities. Records of amounts of medication delivered on days 1 and 2 were kept; at 48 hours postoperatively, patients were given a McGill's Pain Questionnaire for completion and indications of complications were noted. For the purposes of this study, complications were identified as abnormal chest x-ray, fever of 100.5°F or atelectasis identified by auscultation.

Results showed that neither locus of control nor method of pharmacologic administration of analgesic medication had any effect on the dependent variables when measured alone; however, when measured in combination, provided different results. Internally controlled patients used less medication if receiving their analgesic medication by patient controlled analgesia. Internals placed in the somatophysiologic group (TENS) used significantly more medication with adjunctive therapy. Internals perceived significantly less pain if receiving analgesia via PCA. Externals perceived significantly less pain in the TENS group if receiving intermittent dosing.

Complication rate was not predicted by locus of control, method of administration or group membership.

*1990 recipient VA Merit Review Grant, \$19,000

EFFICACY OF RESPIRATORY GAS FILTERS FOR THE REDUCTION OF MICROBIOLOGIC CONTAMINATION OF RESPIRATOR HOSES IN THE VENTILATED ICU PATIENT.

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Introduction, aim of the study. According to manufacturers' information disposable humidifiers have a respiratory gas mixture conditioning effect as well as an antibacterial effect. In the presented study, a rinsing technique was used to detect and quantify possibly bacterial contamination of the ventilator circuit, depending on the application of antibacterial filters mounted between Y-piece and endotrachea tube (ETT) in clinical routine.

Methods. The study was performed on artificially ventilated patients. The filter^{*)} was mounted: in control patients (group A, n=21) between respirator and inspiratory and expiratory hoses, respectively (filters I and II); in groups B and C (n=20/20) additionally between ETT and Y-piece (filter III). Bacterial detection and classification were performed: in all groups in the in- and expiratory hoses, in the water traps, and on the surface of filter II. Examination was carried out after 24 hours in groups A and B, and after 72 hours in group C. Ventilator hoses, water traps, and filters I and II were sterilized before use, and exchanged at the end of the study period; filter III was exchanged daily.

Results. Table: Number of patients with at least 10 colony-forming units in the studied section of the ventilatory circuit. In parantheses: number of patients with the detection of at least 1 germ in the respective section. All differences between group A, and groups B and C were significant (Wilcoxon, $p < 0.05$). Using the technique of rinsing the hoses, water traps, and membranes of the filters, we found germs in at least one part of the circuit in all patients. In group A (no filter) more hoses/water traps were found with a significant contamination. With a filter between ETT and Y-piece, there is no increase of contaminated circuit sections when the time of application is extended from 1 (group B) to 3 days (group C).

| Section | no filter (A) | filter (B) (1 day) | filter (C) (3 days) |
|-------------------------|------------------|-----------------------|------------------------|
| inspiratory hoses | 6 (16) | 1 (9) | 1 (8) |
| inspirator water trap | 6 (11) | 0 (9) | 1 (7) |
| expiratory hoses | 9 (15) | 1 (9) | 0 (11) |
| expiratory water trap | 9 (17) | 0 (5) | 2 (9) |
| filter II, patient side | 4 (8) | 0 (8) | 0 (3) |

Conclusion. 1. When a bacterial filter between ETT and Y-piece is dispensed with, an exchange of hoses is necessary after 24 hours at the latest. 2. Application of bacterial filters can considerably reduce the vital bacterial load of the ventilator hoses in ICU. 3. respirator hoses can be left at the ventilator without the risk of a clinical relevant bacterial contamination for at least 3 days, when a filter between ETT and Y-piece is used. In this case, the bacterial load is not increased as compared with a more frequent exchange of hoses.

^{*)} Pall Ultipor BB 50T.

CARBON DIOXIDE ELIMINATION OF NORMAL TO MODERATELY ADVANCED COPD PATIENTS UNDER THORACOTOMY

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This study tried to evaluate CO₂ elimination by lower frequency IPPV under thoracotomy with observation of both PaCO₂ and PetCO₂. Patients with mild to moderately advanced pulmonary function insufficiency were included, so as to find out the appropriate frequency of IPPV, avoiding hyperventilation.

10 thoracic patients consisted of both normal lung function and COPD groups. All patients were ventilated with 10 bpm TV 10ml/kg over 3 hours. PetCO₂ and PaCO₂ of two groups remained stable within normal range. We predict that the frequency of IPPV from 10 to 12 bpm TV 10ml/kg would be appropriate for CO₂ elimination in thoracic surgery, even in COPD patients with some evidently impaired pulmonary function.

4 cases with severely impaired pulmonary function were traced during thoracic operation. The impairment of pulmonary physiology was so complicated and different from each other, that the management of ventilation should be individualized. It is important to adjust frequency and tidal volume pacing with clinical condition under continuous monitoring of essential vital parameters. Otherwise, spacialized techniques were certainly needed.

**CLARK HEAD TENT AND LARYNG.O₂ FOR THE HIGHEST LEVEL OF
OXYGENATION BEFORE AND DURING INTUBATION**

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Assistance technique : F. DELAPLACE, J. CRISTIN, M. CARPENTIER,
Ph. CLAVEL, R. COTTRELL, Ph. BOCQUET, Ph. BRUNET, G. COACHE,
P. HENRIET, S. LEVASSEUR, G. PEYSERRE

Hypoxia is still important risk with trauma
anesthesia and clinical care situations.

It is very important to control not only SaO₂ but
also the PtcO₂ as often as possible.

A good methode for the highest level of hyperoxia is
the association of head tent before induction and laryng.O₂ for
intubation.

It is essential to obtain the highest PtcO₂ before
and during intubation.

In this situation, it was possible with Tcm3 monitor
(radiometer Copenhagen) to measure PtcO₂ in people (16 health
voluntary + 6 patients for head tent, and the same 6 patients
for intubation).

The mean PtcO₂ is 45,5 KPa (342 mm Hg), after 5
minutes of head tent and 41,1 KPa (309 mm Hg) at the end of
intubation.

This procedure permit to spend more than 10 minutes
for intubation without manual ventilatory assistance, at open
glottis.

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**BLUNT SPLENIC TRAUMA : SUCCESSFUL NONOPERATIVE MANAGEMENT AND
DELAYED RUPTURE. A RETROSPECTIVE ANALYSIS OF PREDICTIVE FACTORS,
INCLUDING COMPUTERIZED TOMODENSITOMETRY (CT) SCORING SYSTEMS**

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Nonoperative management (NOM) of Blunt Splenic Trauma (B.S.T.) in adults has remained controversial throughout its recent development over the past ten years (1) mainly due to the risk of delayed ruptures even though the risk of post splenectomy complications is substantial. Many have tried to find objective criteria for secure N.O. management, including CT scoring systems with dissimilar results (1, 2, 3).

The aim of this study was to analyze clinical and paraclinical data in B.S.T. patients managed non-operatively in order to determine whether criteria for safe N.O. management or predictive factors of delayed rupture could be found.

156 patients admitted to our trauma unit from 1988 to 1991 were retrospectively studied. We focused on a sub-group of 47 patients initially non-operated in the first 24 hours, divided into 3 parts : group I (N=35) with initial N.O. management (IA (N=23) : successful, IB (N=12) : delayed rupture) and group II (N=12) with initially non-diagnosed delayed rupture. Criteria for NOM were : hemodynamic stability, ht stability with minimum blood replacement, no peritoneal signs. The following data were reviewed at different times from pre-hospital care with a minimum 1 month follow-up : abdominal symptoms, hemodynamic status with filling-up and blood transfusion requirements, associated abdominal or extra-abdominal trauma, blood parameters (hematocrit), chest x-rays, sonograms .CT scans, were analyzed blindly with two scoring systems (2, 3). Statistic analyses were performed using Student-T-Test and non parametric test. The main results appear on Chart I.

In group I, NOM was successful in 20 patients ; 3 patients required laparotomy and splenic preservation was possible ; 12 patients (36,3%) required delayed splenectomy (extremis : day 2 to day 27) because of delayed rupture or persistent bleeding. Only one patient died in group IA from associated injuries.

No statistically significant difference was found between the sub-groups for the different parameters studied, except for the CT scoring systems : the Resciniti mean score was significantly lower in group IA (p = 0.007) compared to group IB or II while no patients with delayed rupture had scores lower than 2.5. The same observations were made using the Buntain grading system, but 54% of the patients with delayed rupture had a low grade.

We conclude that in hemodynamically stable patients, clinical and usual paraclinical data cannot predict safe NOM or delayed rupture. Only CT scores, when low, may help choose candidates for safe NOM, with a best accuracy for score including hemoperitoneum quantification.

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3 - J of Trauma, 1988, 28 (6) : 828-831

| GROUP | N | Age mean (extr) | Length of stay mean (extr) | ISS mean (extr) | Abdo-symptoms admission | Packed red cells (mean of units) ± SD | Coloids (ml) mean ± SD | Admission Hematocrit mean ± SD | CT GRADE (1) | | CT SCORE (2) | | CT hemo- peritoneum (3) | |
|-------|----|---------------------|----------------------------------|---------------------|----------------------------|---|---------------------------|--------------------------------------|--------------|-------|--------------|------|----------------------------|-----|
| | | | | | | | | | ≤ II | ≥ III | ≤ 2,5 | ≥ 3 | ≤ 1 | ≥ 2 |
| IA | 23 | 30,21 (3-76) | 22,2 (7-45) | 20,23 (9-41) | 60% | 2,76 ± 4,05 | 940 ± 1290 | 36,4 ± 5,9 | 81% | 19% | 60% | 40% | 54% | 46% |
| IB | 12 | 38,8 (22-71) NS | 28,4 (12-60) NS | 26,67 (16-45) NS | 66% | 4,67 ± 4,50 NS | 1491 ± 1781 | 30,5 ± 12,3 NS | 54,5% | 45,5% | 0 | 100% | 9% | 90% |
| II | 12 | 41,54 (14-74) NS | 34,5 (13-80) NS | 27,27 (16-45) NS | 50% | 7 ± 13,82 NS | 1650 ± 2389 | 35,3 ± 9,8 NS | 60% | 40% | 0 | 100% | 10% | 90% |

Chart 1 ; (1) Buntain grade ; (2) Resciniti score ; (3) Hemoperitoneum (from Buntain)

SERIOUS INJURY IN SPORT AND LEISURE ACTIVITIES.

Many sports involve an element of risk taking, so it is not surprising that there are accidents and injuries. Serious injury is not common but has devastating effects.

Over a 12 month period in the Mersey Region 47 individuals from a population of 3.2 million sustained serious injury, (Injury Severity Score > 15), an incidence of 0.0015%. During this time there were a total of 750,000 new attendances at Accident and Emergency Departments of which approximately 10% were due to sport.

There were 33 cyclists, 5 horse riders, 4 were playing contact team sports, 4 water sports and one individual was piloting a microlight aircraft. The mean age was 37.5 years (4-87), there were 10 children and 83% were male.

None of the cyclists wore helmets and nine (27%) had consumed alcohol just prior to the accident. By comparison all horse riders wore helmets and alcohol was not implicated in any of the other accidents.

Blunt injury was the single mechanism of injury with the head, thorax and abdomen the commonest body regions injured. Head injury was the commonest cause of death (34%).

26 (55%) patients died and survivors had significant residual disability often requiring specialised rehabilitation facilities.

CONCLUSION. Serious injury could be avoided by a combination of education, legislation, proper supervision and safer interpretation of rules.

OXYGEN TRANSPORT SYSTEM DURING HEMOSORPTION IN PATIENTS HAVING PYO-RESORPTIVE INTOXICATION SYNDROME

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Introduction. Inadequacy of the existing methods of intensive therapy for treating pyo-resorptive intoxication has brought about an appearance of new non-medicamental, the so called "afferent", methods. And hemosorption is the basic method of the kind. As a method of intensive therapy hemosorption has been used in clinics since 1982, but there still exist some unsolved problems restricting its application. The main problem here is its influence upon the oxygen transport system.

Methods. Oxygen transport system during hemosorption was investigated in 96 patients suffering from pyo-resorptive intoxication syndrome caused by pyo-destructive lung diseases. A special emphasis was put on an integral index of gas exchange - oxygen tension in arterial blood. The patients had arterial hypoxemia in history, prior to hemosorption. General content of oxygen in arterial blood was 70-75%. The patients having a hyperdynamic type of central hemodynamic disturbances exhibited no change in the transport of oxygen to tissues. An increase of blood flow was accompanied by an increase of oxygen delivery to tissues. The patients having a hypodynamic type of central hemodynamic disturbances showed 42.8% decrease of oxygen transport.

The investigations made showed that hemosorption caused an increase of cardiac output and of fraction of cardiac output, deceleration of cardiac rhythm and enlargement of minute blood volume. At the same time a reduction of systemic vascular resistance in lungs was observed. Hemosorption improved air flow passage in small and middle bronchi.

Hemosorption caused an increase of oxygen tension in arterial blood in both groups of patients. Cardiac index similarly increased. The increased blood flow provided an increase of oxygen transport. After the first time of hemosorption application it increased by 29.4%, after the second - by 48.7%.

The patients having hypodynamic type of disturbances showed practically normal oxygen flow to tissues. This was due both to the conversion of hypodynamics into the condition of hyperdinamia and to the increase of the partial pressure of oxygen in blood.

Discussion. The results obtained have shown that hemosorption influences practically all components of the oxygen transport system: the respiratory component - by bringing about a broncholytic effect which contributing to the improvement of external respiration; the lung component - by normalizing the lung blood flow due to both improvement of central hemodynamics and reduction of lung vascular resistance, and, as a consequence, hemosorption increases oxygen tension in arterial blood.

The multiple system organ failure (MSOF and the incidence of septic complications in severely burned patients

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Introduction and Objective: Sepsis (presently understood as a general inflammatory response) and MOF are still the main cause of death in Burn ICUs. Aim of the study was to demonstrate the incidence and correlation of sepsis and MOF, and the definition of a chronological pattern of organ failure in burn victims.

Material and Methods: 120.000 data over 2886 treatment days of a homogenous population of 100 severely burned patients requiring long term ventilation were analyzed. Parameters for organ function and the definition of organ failure were evaluated for lung, liver, kidney, cardiovascular, coagulation, bone marrow system, and metabolism. Bacteriol. swabs and blood cultures were recorded. Sepsis or sepsis syndrome were defined according to the Bone, VA, and NIH criteria. Patients were scored with ABSI.

Results: Mean tBSA was 41,6 %; 59! patients sustained an inhalation trauma (IHT). Mortality was 22 % in the non-IHT group vs 58 % in the IHT group ($p < 0,05$). Patients with an ABSI > 9 had a 85 % mortality. Mechanical ventilation was applied on 1859 days (lung dysfunction 1°), while lung failure was found on 1259 day (2°) in 87 patients. Circulatory failure was present at 2020 days, kidney failure on 329 days. At the onset of organ failure, 4372 "septic signs" were found in the whole study population. Forty-six patients developed MOF 1&2, mortality in this group was 19 % ($n=9$). Seventeen patients developed MOF 3, 17 had an 4-organ failure and 7 a MOF 5. Of this group ($n=41$), 40 patients had an IHT. Mortality in the group MOF 3-5 was 75 %. Any combination of organ and kidney failure markedly impaired the prognosis. Involvement of the kidney lead to a 84 % mortality.

The lung was the first organ to fail (day 6-8, mean duration-md- 17.6 d.), followed by the bone marrow (day 8-10, md 5.7 d.), the kidney (day 9-11, md 7.7 d), the liver and the circulatory system (day 11-14, md 5.6 and 6.4 d resp.).

All patients fullfilled the criteria of sepsis or sepsis syndrome at the onset of organ failure. Blood cultures were positive in only 15 % at this time.

Conclusions: The results clearly demonstrate the close correlation between sepsis and MOF. Evidence of bacteremia for diagnosis of sepsis is not required. There is a definite pattern of sequential organ failure and a possible interaction due to the constant chronological appearance of organ failure.

INFLUENCE OF NEW HEMOCORRECTOR "LACTOSORBAL" ON ACID-BASE BALANCE IN DOGS UNDERWENT SEVERE HEMORRHAGIC SHOCK

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Among many factors, playing the important role in pathogenesis of irreversible circulatory shock, the particular place is taken by progressing disorders of acid-base balance (ABB) following to the cell's enzymes inactivation and cells death.

The investigations were carried out in 5 mongrels in which the hemorrhagic shock was modelled by momentarily jet hemorrhage from a. femoralis till the arterial blood pressure (ABP) lowered to 40 mm Hg (the bloodloss volume made 30.1 ± 1.3 ml/kg). The blood assays samples were taken from v. cava caudalis before and after 7.5 ± 0.7 hrs of the hemorrhage and then after 1, 24 and 48 hrs of the treatment. The ABB was estimated by pH, pO₂, pCO₂, plasma bicarbonate (HCO₃), standart bicarbonate in blood (SBC), actual base excess in blood (ABE) measured by means of ABL 30 Acid-Base Analyzer (Copenhagen, Denmark). The new hemocorrector "LACTOSORBAL" was used as a plasma substitute which by the decision of Pharmacological Committee of 1989 was allowed to industrial production and clinical use. The treatment was begun after 7.5 ± 0.7 hrs of the hemorrhage in ABP level of 30.0 ± 0.0 mm Hg. "LACTOSORBAL" which is a 5% albumin solution containing sorbitol, sodium lactate, sodium bicarbonate, K⁺, Na⁺, Ca²⁺ was injected into v. femoralis at the dose of 10 ml/kg with a constant intensity of 20 ml/min. The animals considered to be survived were observed during 48 hrs since the period of acute organism reaction on the aggression till resistant stabilization of blood circulation lasts from some hours to 2 days.

It is established that after 7.5 ± 0.7 hrs of the hemorrhage pH, pO₂, HCO₃ and SBC diminished by 4.8% (P<.05), 3.4% (P>.1), 23% (P<.002) and 23.2% (P<.001), while pCO₂ and ABE enlarged by 37.8% and 71.4% (P<.001) correspondently. The "LACTOSORBAL" transfusions were accompanied by the quick and steady stabilization of the systemic hemodynamics indices which already after 1 hr of the treatment had shown the ABP level to enlarge to 71.0 ± 2.4 mm Hg and the central venous pressure from -1.3 ± 0.4 cm H₂O to 3.0 ± 0.4 cm H₂O (P<.001), by the heart rate diminish from 202.4 ± 2.9 to 136.8 ± 7.5 per minute (P>.1). At the same time pH, pO₂, HCO₃ and SBC were lower the initial levels already by 2.6%, 4.1% (P>.1), 15.5% and 13.6% (P<.01) and pCO₂ and ABE were higher only by 19.1% (P>.1) and 47.6% (P<.002) correspondently. By the end of observation period the indices of pH, pO₂, pCO₂, HCO₃, SBC and ABE made correspondently 7.318 ± 0.347 , 142.3 ± 1.6 mm Hg, 44.7 ± 1.5 mm Hg, 17.6 ± 0.6 mmol/l, 18.1 ± 0.8 mmol/l, -8.48 ± 0.4 mmol/l. All the animals have survived. The "LACTOSORBAL" positive influence on ABB is explained as follows. It is known that sodium lactate anion metabolized in Crebs cycle into CO₂ and H₂O. During the reaction between sodium and carbonic acid the sodium bicarbonate is formed which has base-shift action.

Conclusion. The results of present investigation are the experimental ground for "LACTOSORBAL" use for the correction of ABB disorders in circulatory shock of different etiology.

The Hayek Oscillator- an invaluable aid to anaesthesia in endolaryngeal surgery.

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The Hayek Oscillator was developed as an aid to chest and intensive care medicine, being used to ventilate the lungs under a net negative pressure, and also to influence right side cardiac pressures(1). It works by means of a chest mounted perspex cuirass, with a rubber skirt to effect an air seal. The pressure inside the cuirass oscillates around a negative baseline by means of an oscillating pump. Parameters of frequency, cuirass pressure and Inspiratory/Expiratory (I/E) ratio can be varied via a microprocessor keyboard.

We recognised that an external ventilator would be useful to oxygenate patients undergoing endolaryngeal surgery, since currently there is conflict for access between the anaesthetist and the surgeon. A prospective study was therefore carried out to assess its value in microlaryngeal surgery. This is the first study to look at the use of this instrument in this situation. All adult cases admitted for microlaryngeal surgery were entered into the trial. Over a 12 month period there were 23 cases. The age range was 17-73 years, the weight range was 60-105 kilograms. The Hayek Oscillator was used to externally ventilate the patients in all cases without recourse to endotracheal intubation of any sort. Anaesthesia was induced and maintained by an infusion of Diprivan. Muscle relaxation was obtained by bolus doses of suxamethonium intravenously. A nasopharyngeal tube was inserted after the first case, in order to prevent posterior prolapse of the tongue blocking off the airway. Haemoglobin saturation was measured by a finger mounted pulse oximeter. End-tidal CO₂ was measured before and after the procedure.

Two problems were encountered. The first occurred in the first case, when posterior prolapse of the tongue occurred before the endoscope was introduced. This led to a rapid fall in the haemoglobin oxygen saturation, which was resurrected after the endoscope was introduced. The second complication, a minor epistaxis, occurred as a consequence of insertion of the nasopharyngeal tube.

Surgery was performed using a Zeiss microscope with a 400mm lens. Suspensory apparatus for the Kleinsasser endoscopes was designed by Dilkes and Hayek. All microlaryngeal surgery was possible, the instrument being particularly useful in laser vaporisation of vocal cord nodules, since there was no tube to ignite. The Hayek Oscillator pressures and frequency were changed until minimal vocal cord movement occurred. No vocal cord movement could be achieved by stopping the machine for a few seconds, this was particularly useful in laser surgery.

We found this technique to be a safe way of ventilating patients undergoing endolaryngeal surgery. Surgical access was markedly improved over standard techniques, which have other, more hazardous side effects(2).

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High Dose L-Epinephrine for Resuscitation in preclinical emergency medicine

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Various reports have suggested, that epinephrine given in amounts above the currently recommended dosage may improve the resuscitation rates in cardiac arrests [1,2,3]. The experiences however are still limited to small numbers of cases or hospitalised patients respectively.

Aim of the study was to evaluate the promising experiences with high dose epinephrine reported, in daily practice of an ambulance car.

Methods: Patients with pre hospital cardiac arrests treated by the ambulance team, were randomly allocated to receive a usual standard dose of 1 mg epinephrine (group A) or the higher dose of 5 mg epinephrine (group B) as immediate transtracheal bolus. ECG was registered before, during and after the resuscitation. The number of defibrillations, adjuvant drugs as well as primary outcome (admission to hospital) and final outcome (discharge of hospital) of primarily successful resuscitated patient was also registered. t-test and Fishers exact test were applicated for statistical analyses.

Results: In total 26 patients (16 male age 59.9 ± 14.9 10 female age 75.3 ± 7.7) had to be resuscitated because of asystolia (total 23, group A = 12) or fibrillation (total 3, group A = 1). Cardiac status at arrival of the ambulance asystolia(=asyst) or ventricular fibrillation(=fibr.), reaction to epinephrine and resuscitation permanent asystolia (=none), ventricular fibrillation (=fibr.), rhythmic or arrhythmic heart action (=action), number of patients beeing primarily successful defibrillated (=defibri.), admission rates= outc.I and final discharges of the hospital= outc.II are presented in the table. Significant differences between the groups are expressed with *)= $p < 0.05$ and $p < 0.01$ respectively.

| Group | age | male | female | asyst. | fibrill. | none | fibrill. | action | defibr. | outc.I | outc.II |
|-------|------------|------|--------|--------|----------|------|----------|--------|---------|--------|---------|
| A | 65.1 | 9 | 4 | 12 | 1 | 7 | 2 | 4 | 4 | 4 | 3 |
| SD | ± 14.3 | | | | | | *) | | **) | | |
| B | 66.7 | 7 | 6 | 11 | 2 | 2 | 6 | 5 | 11 | 8 | 4 |
| SD | ± 15.6 | | | | | | | | | | |

The average time from alarm of the ambulance car until first medical action was 5.0 ± 2.2 min in group A and 4.3 ± 2.0 min in group B however this time did not corellate with the period of cardiac arrest, since the latter was not evaluable.

Conclusions: The results show clearly, that high dose epinephrine used for resuscitation in prehospital treatment is able to induce cardiac action in a significantly higher rate than the standard dose. This resulted also in a much better first outcome (hospital admission rate) than standard dose epinephrine. It has to be considered however, that preclinical resuscitation is usually complicated by underlying disease such as severe cardiac decompensation, polytrauma and/or hypovolemic shock wich was reflected to the the final outcome rate.

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REPERCUSSIONS OF PROLONGED LOWER BODY POSITIVE PRESSURE (LBPP) ON MUSCULAR ISCHEMIA IN CARDIAC SURGICAL INTENSIVE CARE UNIT.

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Introduction : Medical Antishock Trousers (MAST) is widely used in the prehospital and inhospital management of hemorrhagic shock to maintain blood pressure. Its benefit continues when it is inflated for a longer period (1), but side effects such as decrease in muscular oxygenation may occur(2). This study was designed to evaluate the local muscular ischemia during a long-lasting MAST inflation (24 hrs) in moderate hypovolemic patients during the postcardio-surgical period.

Material and methods : 58 patients (59 ± 14 yrs SD) were studied during the immediate postoperative period after coronary artery bypass grafting or valvular replacement. They were randomized in two groups : with (MAST + : lower limb = 35 mmHg ; abdomen = 10 mmHg) and without (MAST -). Exclusion criteria : hepatic failure, lower limb arteritis, hemodynamic pulmonary edema. Serum enzyme levels of total creatine kinase (CK) were measured using radio-immuno assay just before (control), 6, 12 and 24 hours after the beginning of the protocol. Electrophoresis was performed when CK were > 250 UI/l. CK selected concerned those patients in which the fraction of isoenzyme CK-MM was $> 98\%$ (indicating skeletal muscular ischemia). Statistics were performed by analysis of variance and by the non parametric Mann-Whitney test.

Results :

1) There was no difference in CK levels at T0 (CKo) between the 2 groups (MAST + = 226 ± 20 ; MAST - = 203 ± 23). Peak of CK (CKp) was significantly higher in the MAST + group (952 ± 180 vs 576 ± 115 ; $p < .05$).

2) In coronary patients, MAST increased in a significant larger extend of CK levels.

3) In valvular patients, CK levels significantly increased but similarly in both groups, suggesting an absence of MAST effect

4) Coronary vs valvular patients : there was no difference in CKo levels ($n = 19$; CKo = 239 ± 22 vs $n = 19$; CKo = 189 ± 20). However CKp was more elevated in the coronary patients (1022 ± 190 vs 396 ± 74 ; $p < .001$).

| Mean \pm SE | | n | CKo (UI/l) | CKp (UI/l) |
|------------------|----------|----|--------------|----------------------|
| MAST + n = 29 | Coronary | 16 | 233 ± 25 | $1308 \pm 283^{*\$}$ |
| | Valvular | 13 | 217 ± 34 | $513 \pm 129^*$ |
| MAST - n = 29 | Coronary | 13 | 247 ± 41 | $779 \pm 227^*$ |
| | Valvular | 16 | 166 ± 29 | $410 \pm 85^*$ |

* : $p < .05$ peak vs control ; \$: $p < .05$ MAST + vs MAST -

Discussion : In all patients, skeletal muscular ischemia occurred postoperatively. However, the MAST inflation aggravated muscular ischemia only on the coronary group, suggesting a higher sensibility of skeletal muscle to ischemia in coronary artery disease. These results allow to cautiously use this device because of the risks of rhabdomyolysis and renal failure.

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SUCCESSFUL CARDIAC RESUSCITATION FOR A PATIENT WITH HYPERALDOSTERONEMIA

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A 57-year-old man with primary aldosteronism was brought to the emergency room on 13 Feb. 1992. Endotracheal intubation and mechanical management of respiration was administered. The following day, ventricular premature beats appeared and then, ventricular fibrillation began to occur. His heart was resuscitated by cardiac electric defibrillation. On 15 Feb. cardiac arrest of the patient occurred and cardioversion of his heart was obtained with external cardiac electric pacemaker. The serum potassium values of the patient were measured with the range of 2.2 to 1.4 mmol/L. Right adrenalectomy was performed under the anesthesia of Isoflurane, N₂O and O₂ on 5 Mar. The pathological diagnoses is adrenocortical carcinoma. The patient was discharged on 16 Mar.

PROPOFOL ANAESTHESIA IN EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY
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In this study effects of propofol anaesthesia on cardiovascular and respiratory parameters in urolithiasis treated with extracorporeal shock wave lithotripsy were aimed to be evaluated.

10 Male, 7 female patients with a mean age of 39.1 year, mean weight of 62.29 kg and mean extracorporeal shock wave lithotripsy time of 76.05 min were studied. All patients were premedicated with 0.02mg/kg atropine sulphate intravenously. General anaesthesia was induced with 2.5mg/kg intravenous propofol and was maintained with gradually decreasing rates of propofol infusions (14, 12, 10, 8, 4 and 2mg/kg/hr). Respiratory rate, end-tidal carbon-dioxide value, capillary oxygen saturation, heart rate, systolic and diastolic blood pressure were recorded for all patients before the induction of anaesthesia (control value), 60 second after the infusion rate was decreased every time and after recovery.

Respiratory rate, end-tidal carbondioxide value and capillary oxygen saturation on each occasion did not differ from the control values. Heart rate was found to be decreased during induction and when the infusion rate was 14mg/kg/hr and 2mg/kg/hr, whereas it was found to be increased in all the other occasions. Systolic blood pressure decreased on all occasions when compared to the control value, whereas diastolic blood pressure increased at 2mg/kg/hr infusion rate and after recovery and decreased on all other occasions when compared to the control value ($p < 0.05$). No changes attributable to the drug was observed in the other parameters.

Therefore taking into account that propofol provides perfect analgesia without causing any depression in respiratory system functions. It was concluded that, the agent could safely be used in patients without cardiovascular risk factors.

EFFECTIVENESS OF HYPERBARIC OXYGENATION IN THE TREATMENT OF ACUTE TRAUMATIC ISCHEMIA.

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Acute crush injury to an extremity may cause severe edema and ischemia in tissue and capillary beds not relived by restoration of arterial perfusion. Hyperbaric oxygen therapy may aid salvage during the acute stages of revascularization by reducing edema via vasoconstriction and increasing oxygen delivery via plasma flow.

In the period from 1987 to 1992, 32 patients aged between 8 and 76 years were admitted to CCU Tallinn Emergency Care Hospital with traumatic injuries of extremities of various localizations, with crush syndrome and damage of main vessels. A course of HBO treatment consisted of 3 to 10 sessions at a pressure of 1,4 - 2,0 atm. for 25-40 min. each. The device we use in our hospital is "OKA-MT" (produces in Kiev, Ukraine).

Analysis of the results showed a high effectiveness of HBO with crush syndrome: oxygenation of injured extremities improved, diuresis restored, development of acute kidney insufficiency was prevented. HBO exerted a pronounced favourable effect on the wound process preventing and decreasing the intensity of suppuration. At the same time normalization of clinico-biochemical indices took less time as compared to untreated by HBO patients.

Thus, we have used HBO therapy successfully as an adjunct to surgery in crush injuries and damage of main vessels. Additional evidence has demonstrated that HBO therapy may also serve as an adjunct therapy in the compartment syndrome. Our experience enables us to recommend HBO for use as a complex treatment of patients with severe injuries as early as possible.



EPIDURAL ANESTHESIA IN CHILDREN IN ORTHOPEDIC SURGERY

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Regional anesthesia in children is used worldwide in abdominal and urologic surgery but was neglected in orthopedic surgery.

We evaluated epidural anesthesia in children of 4 months to 12 years of age undergoing orthopedic pelvis and lower limb surgery. Children were classified into two groups by age: till 7 years and from 7-12 years and also in two groups by site of surgery: pelvis, hip (12 children - 16 operations) 7 aged 4 months - 7 years, 3 aged 7-12 years; feet 7 children aged 1-5 years. All children were anesthetized with N_2 , O_2 , 50%/50% and Halothane 0,5%, their trachea was intubated. Using a standardized technique in children till 7 years of age caudal anesthesia was induced, they received 0,25% bupivacaine 1 ml/kg B.W.. In children from 7-12 years of age epidural lumbar anesthesia was induced, they received 0,25% bupivacaine 0,75 ml/kg B.W. and epidural catheter G 20. We observed cardiovascular and respiratory functions, efficiency of analgesia during surgery and need for analgetics after surgery.

We concluded that for children undergoing pelvis and hip surgery epidural anesthesia provided total analgesia and optimal cardiovascular stability while surgery was in progress. After the surgery they needed analgetics for the first time after 6-8 hours. In children undergoing feet surgery who received caudal block, analgesia was unsatisfactory at the beginning of the surgery and in 2 patients also meanwhile. Caudal block also faded after 1-2 hours and analgetics often had to be used immediately after the surgery, so for this kind of surgery subarachnoid anesthesia would be the method of choice.

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